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COMPARISON OF TWO FORMS OF ANTECEDENT EXERCISE AND THEIR EFFECTS ON INAPPROPRIATE BEHAVIORS AND APPROPRIATE RESPONDING WITH INDIVIDUALS WITH SEVERE DISABILITIES

BY

DENIS FORTIN

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION IN SPECIAL EDUCATION (SEVERE DISABILITIES)

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

(SPRING) (1991)

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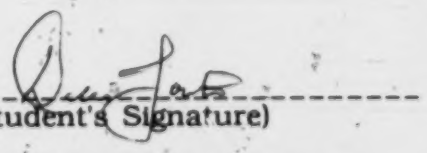

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SUBMITTED BY DENIS FORTIN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF EDUCATION IN SPECIAL EDUCATION (SEVERE DISABILITIES)

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ABSTRACT

In this study, the effect of two forms of aerobic exercise on inappropriate behavior and appropriate responding with two autistic teenagers was investigated. Ten minutes of aerobic dancing and ten minutes of jogging were compared using an alternating treatment design and maintaining constant the intensity of the two conditions with a sport monitor. Multiple forms of stereotyped behaviors as well as other inappropriate behaviors and appropriate responding were measured with a ten seconds interval recording system. A videosystem was used to measure the occurrences of the target responses of the two children during a thirty minute recording period following the exercise session. The results showed that both types of exercise were generally effective. However, the results also showed that dancing was generally more effective than jogging in reducing inappropriate behaviors and that for one subject the control condition was more effective than jogging for several behaviors. A statistically significant difference between the effects of the two treatments was obtained for one subject but not for the other. In addition, both jogging and dancing improved appropriate responding over the baseline rate. Using correlation patterns, it was found that the behavioral changes produced by the two types of exercise were different. Also while most target inappropriate behaviors decreased compared to the baseline rate, some behaviors increased suggesting that different behaviors were differentially affected by exercise. Several explanations for the difference were provided. –

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TABLE OF CONTENTS

CHAPTER	PAGE
I- INTRODUCTION	1
BEHAVIORAL PROBLEMS IN SPECIAL POPULATIONS	2
THE RESEARCH PROBLEM AND ITS CONTEXT	3
II- DEFINITIONS AND PROBLEM DESCRIPTION	6
SEVERE DISABILITIES	6
BEHAVIOR PROBLEMS	8
PROBLEM DESCRIPTION	10
III-STEREOTYPED BEHAVIOR: NATURE AND TREATMENT	13
NATURE OF STEREOTYPED BEHAVIOR	13
TREATMENTS	23
ROLE OF SENSORY STIMULATION	28
IV- EXERCISE, FITNESS AND APPLICATIONS	35
BIOLOGICAL ASPECT OF EXERCISE	36
EFFECTS AND APPLICATIONS OF EXERCISE	38
EXERCISE AND INTELLECTUAL DEFICIENCY	42
V- METHODS AND PROCEDURES	54
VI- RESULTS	73
SUBJECT 1	73
SUBJECT 2	98
VII-DISCUSSION	116
CONCLUSION	126
REFERENCES AND BIBLIOGRAPHY	130
APPENDIX 1	149
APPENDIX 2	153

LIST OF TABLES

TABLE		PAGE
TABLE 1.	Percent interobserver reliability for multiple behaviors for subject 1 and subject 2	72
TABLE 2	Average heart rate and its range for each session of jogging and dancing for subject 1	75
TABLE 3.	Codes and Definitions for subject 1	77
TABLE 4.	Total average in percentage of interval occurrences for each treatment and each measured behavior for subject 1	79
TABLE 5	Average heart rate and its range for each session of jogging and dancing for subject 2	100
TABLE 6	Codes and Definitions for subject 2	101
TABLE 7	Total average in percentage of interval occurrences for each treatment and each measured behavior for subject 2	103

LIST OF FIGURES

FIGURE		PAGE
FIGURE 1	Data sheet for heart rate recording	61
FIGURE 2.	Data collection for variables associated with each measurement period	66
FIGURE 3.	Data collection for inappropriate behaviors for subject 1	68
FIGURE 4	Data collection for inappropriate behaviors for subject 2	69
FIGURE 5	Data collection for appropriate responding for subject 1	70
FIGURE 5a	Data collection for appropriate responding for subject 2	71
FIGURE 6.	Comparison of heart rate in beats per minutes per session for subject 1	74
FIGURE 7.	Comparison of heart rate in beats per minutes per session for subject 1 (morning sessions only)	74
FIGURE 8.	Comparison of inappropriate behavior (Beh. Tot) in percentage of interval occurrences per session for subject 1	81
FIGURE 9.	Comparison of inappropriate behavior (Beh. Tot.) in percentage of interval occurrences per session for subject 1 (morning sessions only)	81
FIGURE10	Comparison of hand shaking (Beh. H) in percentage of interval occurrences per session for subject 1	83
FIGURE 11	Comparison of hand shaking (Beh. H) in percentage of interval occurrences per session for subject 1 (morning sessions only)	83
FIGURE 12	Comparison of eye socket (beh. E) in percentage of interval occurrences per session for subject 1	85

LIST OF FIGURES

FIGURE		PAGE
FIGURE 13	Comparison of eye socket (beh. E) in percentage of interval occurrences per session for subject 1 (morning sessions only)	85
FIGURE 14	Comparison of other behavior (Beh. O) in percentage of interval occurrences per session for subject 1	89
FIGURE 15	Comparison of other behavior (Beh. O) in percentage of interval occurrences per session for subject 1 (morning sessions only	89
FIGURE 16	Comparison of body rocking, head and legs swinging (Beh. A) in percentage of interval occurrences per session for subject 1	91
FIGURE 17	Comparison of body rocking, head and legs swinging (Beh. A) in percentage of interval occurrences per session for subject 1 (morning sessions only)	91
FIGURE 18	Comparison of breathing noise (Beh. Br) in percentage of interval occurrences per session for subject 1	93
FIGURE 19	Comparison of breathing noise (Beh. Br) in percentage of interval occurrences per session for subject 1 (morning sessions only)	93
FIGURE 20	Comparison of intervals with breathing noise only (Beh. Br) in percentage of interval occurrences per session for subject 1	94
FIGURE 21	Comparison of appropriate responding (App. Resp) in percentage of interval occurrences per session for subject 1	97
FIGURE 22	Comparison of appropriate responding (App. Resp) in percentage of interval occurrences per session for subject 1 (morning sessions only)	97
FIGURE 23	Comparison of heart rate in beats per minutes per session for subject 2	99

LIST OF FIGURES

FIGURE PAGE

FIGURE 24 Comparison of inappropriate behavior (Beh. Tot) in percentage of interval occurrences per session for subject 2 — 104

FIGURE 25 Comparison of fingers in mouth (Beh. A) in percentage of interval occurrences per session for subject 2 — 106

FIGURE 26 Comparison of gazing (Beh. B) in percentage of interval occurrences per session for subject 2 — 108

FIGURE 27 Comparison of body rocking swinging and tapping (Beh. C) in percentage of interval occurrences per session for subject 2 — 110

FIGURE 28 Comparison of vocalization (Beh. D) in percentage of interval occurrences per session for subject 2 — 111

FIGURE 29 Comparison of appropriate responding (App. Resp) in percentage of interval occurrences per session for subject 2 — 113

CHAPTER I

INTRODUCTION

Perhaps one of the most challenging problems encountered by parents, educators and other professionals and paraprofessionals involved with children is associated with the presence of emotional or behavioral disturbances. For some children, the presence of hostility, verbal and physical aggression, hyperactivity, social inadequacy, disobedience, withdrawal or other forms of inappropriate behavior is transitory. Problematic behaviors, although considered as an added burden by caregivers, may be acceptable as long as they don't persist or endanger the child or other members of society. Stress within the family such as a divorce, parental conflicts, chronic illnesses or other psychosocial factors such as problems at school or with peers are some of the factors that may precipitate maladaptive behavior in some children. Generally, children outgrow these inappropriate responses. However, for some children, behavioral disturbances may persist and considerably deviate from the behavior of most individuals of the same age group. According to Winzer, Rogow, and David (1987), it is estimated that about 6 to 8 percent of school-age children exhibit "serious and persistent behavior problems". In addition, it is estimated that approximatively one in eight children in Canada has an emotional or learning disorder that will interfere with development unless some form of intervention takes place. Although perhaps alarming, these figures probably underestimate the incidence of behavioral difficulties among persons with other forms of disabilities.

Behavioral problems in special populations

Most children identified as emotionally/behaviorally disturbed fall into the mild or moderate categories and, according to Winzer and associates (1987), come to the attention of professionals in middle childhood or early teen years. However, according to these authors for some other individuals, the presence of behavioral problems may be complicated by other disabling conditions. In fact, emotional or behavioral disturbance is often associated with other handicapping conditions such as a hearing or learning impairment or a mental disability (Winzer et al., 1987). For example, among individuals with mental disabilities, it seems that various emotional and behavioral disturbances or disorders are more prevalent than in the general population. Various studies report that up to 50 percent or more of persons referred for institutional placement display clear indices of emotional and/or behavioral disorders (Karen, William & Gardner, 1983).

For some other individuals with disabilities, the behavioral and emotional disturbances can be so serious that they may require immediate attention and constant supervision. For example, individuals with autism or schizophrenia are generally described as having severe or profound behavioral or emotional disturbances (Rutherford, Nelson & Forness, 1988). These persons frequently exhibit bizarre and inappropriate behaviors. They may engage in self-stimulation and self-mutilation or self-injurious behavior (Winzer et al. 1987). However other persons with severe handicapping conditions may also engage in various forms of inappropriate behaviors including

self-injurious behavior. These individuals may have severe or profound intellectual disabilities and/or multiple impairments.

The research problem and its context

Aberrant behaviors such as self-injurious behaviors and various forms of stereotyped behaviors, also called self-stimulation, are often present in the population of individuals with severe disabilities (Jones, 1988; Ludow, & Sobsey,1984). These behaviors typically interfere with learning and contribute to the perception of the individual as deviant. Many approaches to the treatment of maladaptive behaviors have been used. However, most treatments require direct intervention contingent on the occurrence of the inappropriate behavior (Cipani, 1989). Thus they often require constant vigilance and they are likely impractical or difficult to implement in a classroom or in other community environments. In addition the aversive nature of many punishment procedures used may raises serious ethical questions about the use of these procedures. and their application often requires complex administrative controls. In light of these problems, some researchers have successfully attempted to reduce some of these behaviors by rearranging the antecedent stimulus condition. For example, physical exercise has been found to decrease self-stimulation (Alajajian,1981; Kern, Koegel & Dunlap,1984; Kern, Koegel, Dyer, Blew & Fenton, 1982; Ohlson, 1978; Watters & Watters, 1980) as well as some forms of self-injurious behavior (Baumeister & Maclean, 1984). More recently other behaviors related to hyperactivity, aggression, and several additional categories were also reduced following exercise sessions (Bachman & Fuqua, 1983; Jansma & Combs, 1987; McGimsey & Favell, 1988). The mechanisms

by which exercise produced the desired effects, the type of exercise and the quantity required to reduce aberrant behaviors remains unknown.

On the other hand, researchers such as Rincover, Cook, Peoples and Packard (1979) have also examined the effects of sensory extinction and sensory reinforcement on self-stimulation and self-injurious behavior. They showed that sensory extinction (i.e, the removal of the hypothesized source of stimulation produced by some forms of aberrant behaviors) was a powerful tool to decrease aberrant behavior. Sensory extinction can also be used as an assessment tool to identify the sensory condition maintaining the behaviors (Rincover, Cook, Peoples & Packard; 1979). Once the sensory consequence was identified, activities such as play providing corresponding stimulatory consequences were developed. These matched activities substantially reduced self-stimulation or self-injury.

In the following study, two forms of antecedent exercise which are used as antecedent intervention conditions are compared. Jogging and aerobic dance are compared for relative effectiveness in reducing selected maladaptive behaviors but also on the level of stimulation provided by both types of aerobic activities. However, prior to describing this comparative study, the target population and its problems are defined in chapter II. Also, difficulties related to the presence of behavior problems within the population of individual with severe disabilities are described in this section. Chapter III reviews the literature related to the nature and treatment of stereotyped behaviors (it includes subsections on the role of stimulation and sensory channels in the behavior). The literature related to exercise

and its applications including its use in reducing behavior excess, is reviewed in chapter IV.

CHAPTER II

DEFINITIONS AND PROBLEM DESCRIPTION

Severe disabilities

Learners with severe disabilities have traditionally been classified as emotionally disturbed, autistic, schizophrenic, deaf-blind, severely or profoundly mentally retarded, and/or multiply handicapped (Stainback & Stainback, 1985). According to Stainback and Stainback (1985), historically they have been called idiots, imbeciles, psychotics, and cripples and have been described as trainable, subtrainable, multihandicapped, semi-independent, and retardates. Thus, the group described as severely disabled is heterogeneous and difficult to define. Individuals with severe disabilities differ widely in terms of physical and developmental impairments and behavioral disturbances, but generally they exhibit significant chronic impairments in all major areas of life functioning. Also, ongoing support is generally required.

Many particular conditions are generally encountered in individuals described as severely disabled (Ludow and Sobsey, 1984). Congenital defects such as mental retardation, vision and hearing impairments, and brain damage can be present. Also, neurological impairments including convulsive disorders are common. Health problems often related to neurological impairment are also prevalent in the population of persons with severe disabilities. Related to their developmental impairments, they may present a deficiency in general maturational level, physical, socio-emotional, cognitive or sensory development or in several of these areas.

Concerning the behavior of individuals with severe disabilities, a variety of inappropriate or atypical behaviors may be displayed. It is important to note however that although these behaviors may be common among this population, they are not necessarily inherent characteristics. The behaviors that can be present in individuals with severe disabilities may range from bizarre vocalization such as echolalia (repetition of the same phrase over and over) to self-mutilation or self-injurious behavior (repetitive behaviors such as head banging or hand biting that may inflict physical damage to the body). Individuals with severe disabilities may typically engage in ritualistic behaviors or repetitive and compulsive sequences of behaviors that must be performed prior to certain activities such as sitting in a favorite chair in a specific location. They may also engage in stereotyped behaviors or self-stimulation or repetitive behaviors assumed to provide continuous visual, auditory, tactile or kinesthetic stimulation such as rocking, teeth grinding, finger twirling and several more (ritualistic behaviors are generally not differentiated from stereotyped behaviors). Other inappropriate behaviors such as aggressive or disruptive behaviors, which are also found in other special or normal populations, may also be displayed by individuals with severe or profound disabilities, but they are not behavioral characteristics typical of this population.

Many positive characteristics are also present. Individuals with severe disabilities do not present only behavioral, physical, or other deficits as may be suggested when describing the group. This type of description focuses exclusively on negative characteristics that individuals with severe disabilities may display. While many of them

present one or more of the described characteristics, individuals rarely possess the majority of them. Individuals with severe or profound disabilities also have many positive characteristics such as warmth and sense of humor. They may independently perform skills such as dressing, cooking (Stainback, & Stainback, 1985) and many others while remaining dependent in other areas of functioning. While it would be inaccurate to overlook many behavior deficits present in individuals with severe disabilities, it would also be inaccurate to overlook positive characteristics. Some individuals with severe or profound disabilities may possess very limited skills in many areas of functioning while others may be semi-independent and require some assistance in only few areas such as money management, cooking, and decision-making.

Behavior problems

Generally, the term "behavior problem" is used in reference to behavioral deficiencies (too little behavior of a particular type), behavioral excesses (too much behavior of a particular type) or behavioral inappropriateness (doing the wrong thing for the time and/or place) (Martin & Pear, 1988). From a behavioral perspective, the inner state of the individual is not directly of concern. Instead the behavior or the observable action, performance, activity, or response, possibly reflecting inner state, is of concern. Thus, the categorization "behavior problems" or inappropriate, maladaptive, or aberrant behavior depend on the perception by other people, of the target behavior as deviant .

However, it may be misleading to use the term behavior problem in reference to a behavior judged as problematic with individuals with

severe disabilities because they are likely to lack skills in many areas. The term is usually utilized in reference to behaviors that deviate from the norm. However, having a label such as severe disability already suggests that the individual competencies and behavior largely deviate from the norm. It is thus difficult to pinpoint which behavior is "the behavior problem" with this population. Obviously, the term is often used in a narrower sense. For the present purpose, the terms behavior problem, maladaptive, aberrant, or inappropriate behavior are used throughout the text in reference to behavior "excesses" that are judged by parents, teachers, and other people working with that person as being inappropriate and/or threatening to the individual and/or society.

In general it is relatively easy to identify what constitutes a behavioral excess in persons with severely handicapping conditions or in individuals with other special needs. However it is generally more difficult to determine what constitutes behavioral inappropriateness or behavioral deficiencies or even which one of many behavior excesses will require an intervention. Generally in these cases, a complete curriculum methodology has to be adopted. Thus the decisions concerning problem behaviors are generally not so simple to make. As pointed out by Donnelan and Kilman (1986), often

> "the problem lies not in the behavior but in the fact that the person does not know the appropriate social rules relative to the behavior. Often, then, the issue is not one of eliminating the behavior but of bringing the behavior under more appropriate stimulus control or of reducing it to a socially appropriate level" (p.221).

Priority behaviors for intervention must be determined since several behaviors may be pinpointed at one time as a result of assessment by the interdisciplinary team. A complete educational technology is available to help with this task. For example a specialized graduate program related to the education and treatment of individuals with disabilities is offered at the University of Alberta. Also, several sources related to decision making (see Evans & Meyer, 1985; Donnelan, Lavigna, Zambito & Thvedt, 1985; Gaylord-Ross, 1980) and to social competencies (e.g., Donnelan & Kilman, 1986; Gast & Wolery, 1987; Horner, Meyer & Bud Frederick, 1986; Meyer, McQuarter & Kishi, 1985; Wehman, 1985) are available.

Problem description

Historically, individuals with various forms of physical, mental, and intellectual disabilities or with any combination of these were placed in large institutions away from the mainstream of society. However in the last two decades, a new trend has taken place. Many individuals with various handicapping conditions have been transferred to community environments such as in regular schools, and group homes or apartments away from large institutions and residential schools (Gast & Wolery, 1987) .

According to Donnelan and Lavigna (1988), radical changes in attitudes about service for individuals with special educational and developmental needs have taken place in the last fifteen years. Nonetheless, from the author knowledge many individuals with severe or profound developmental disabilities remain in larger institutions or in other non-integrated settings. It would seem that the less severe the handicapping conditions of a person, the more likely the person is

integrated to more normal environments. In fact, the level of social competence of individuals with severe disabilities is often cited as a feature that makes integration difficult for them (Wehman, 1985). Typically, individuals with severe and multiple disabilities may be considered at risk of being socially rejected (Cipani, 1989; Gast & Wolery, 1987).

When individuals with severe disabilities also display maladaptive behaviors such as aggressive and disruptive behaviors, it is likely that their chance of being integrated in a less restrictive environment are reduced (Cipani, 1989). On the other hand, for individuals with severe disabilities who have already functioned in less restrictive environments, the presence of aberrant behaviors such as self-injurious, aggressive, destructive, stereotyped or other behaviors may also lead to social rejection by peers and by other members of society.

The social rejection and or difficulties in coping with the individual may lead to what Sobsey and McDonald (1988) called "backward transition". That is, instead of placing the individual in a less and less restrictive environment closer to a normal life situation, that individual could be "moved backward" or returned to a more restrictive situation or environment such as from a group home to a large institution where he or she may remain. In addition, maladaptive behavior may not only be problematic for the individual displaying the behaviors but also it may reinforce negative attitudes in the general population toward the group of individuals with severe disabilities (Meyer & Evans, 1985).

Thus, in order to prevent social rejection and/or a backward transition, the aberrant behaviors of individuals with severe disabilities

should be prevented, eliminated, or at least reduced by using the best possible technology available. Several forms of interventions have historically been attempted to eliminate behavior problems ranging from very aversive forms of punishment to educative approaches including social skills training. However, until recently, with the exception of drug therapy, most treatments required a direct intervention contingent on the occurrence of the inappropriate behaviors (Cipani, 1989). These treatments generally required a structured environment in which the consequence of the behavior can be altered. For this reason they are often impractical or at the very least very difficult to implement in settings such as in a classroom where instructional time has to be equally distributed among students. In light of this problem, some researchers have successfully attempted to reduce maladaptive behaviors by rearranging the antecedent stimulus conditions associated with inappropriate behaviors. Many educational techniques are now available for reducing behavior problems. The use of antecedent exercise is only one example of special antecedent conditions positively affecting behavior (Evans, & Meyer, 1985). Research on antecedent forms of interventions are and will continue to be needed in special education and rehabilitation as, it seems, that individuals with challenging needs will be increasingly integrated and served in community environments. The techniques chosen to deal with excess behavior will need to be tested but also, socially validated before using them in the community.

In the next chapter the range of treatments used with stereotyped behavior including self-injurious behavior is presented, and information on the nature of the behavior is also provided.

CHAPTER III

STEREOTYPED BEHAVIOR: NATURE AND TREATMENT

One type of behavior problem that has fascinated psychologists is the stereotyped behavior which is often displayed by individuals with severe disabilities. For a long time it had been viewed as a non-functional behavior that had to be reduced prior to teaching any appropriate response (Koegel & Covert, 1972), but it is now recognized that the behavior does not always interfere with learning (Jones, 1988; Klier & Harris, 1977). In this section information related to the nature and the treatment of stereotyped behavior, and the role of sensory stimulation and of sensory channels in the presence of the behavior are presented. Self-injurious behavior is also included in this section for the purpose of demonstrating the possible range of aberrant behaviors and treatments of individual with severe disabilities, and also because it is often viewed as a form of stereotyped behavior. However, the debate over the classification of self-injurious behavior as a form of stereotyped behavior continues (Jones, 1988).

Nature of stereotyped behavior

Stereotyped behavior is often referred to as "self-stimulation" or "stereotypic behavior" or "responding", or as "autistic mannerisms" or "blindisms". It can be defined as repetitive and ritualistic acts that do not appear to serve a functional purpose. Other definitions also have been proposed. Jones (1988) defined stereotyped behavior as "immature voluntary behaviors in the repertoire for a long time and out of synchronism with "normal" development, whose patterns tend to be unresponsive to environmental change" (p. 175). Stereotyped behavior appeared to be inversely related to the degree of intellectual

functioning and the level of play (Jones, 1988). Stereotyped behaviors are behaviors such as rhythmic movements of the body or body parts, mouthing, repeated non-linguistic vocalizations, spinning while standing up, rubbing a surface or oneself, and many others that do not generally appear to be maintained by social consequences. Fifty topographies have been studied in the applied literature alone (Lovaas, Newsom & Hickman, 1987). According to Lovaas and associates (1987), sometimes the behavior appears to produce primarily visual stimulation, sometimes it appears to produce tactile input, sometimes auditory stimulation seems to be the primary source of feedback while other times the source of stimulation may be vestibular such as when the individual engages in body rocking or head nodding. The vestibular stimulation occurs through the vestibular receptors which are specialized proprioceptors. The vestibular receptors are responsible for the posture, the equilibrium, the muscular tone, and spatial orientation. Most proprioceptors are located in the muscles, joints, ligaments and bones while the center of vestibular stimulation is located in the inner ears. The term kinesthesia is used in reference to the awareness of position and movement which rely on proprioceptive information (Seaman & Depauw, 1989).

Although most forms of stereotyped behavior are not associated with a particular antecedent or consequence, there have been reported cases suggesting that in some instances the behavior is in fact related to these. For example, in a study from Wieseler, Hanson, Chamberlain, and Thompson (1985) it was found that seven percent of stereotypic behavior was related to positive consequences or escape from or avoidance of a demand. In Durand and Carr's well controlled

study (1987), it was shown that increasing task demands for four developmentally disabled children also increased the frequency of body rocking and hand clapping thus suggesting that the behavior could have served a social function, that is to escape from an aversive situation. Of course, this increase could also be explained by simple excitement.

Often self-injurious behavior and self-stimulation are viewed as behaviors in the same category (Baumeister & MacLean, 1984; Gordon-Smith & Matson, 1984; Edelson, 1984) because at least in some cases self-injurious behavior, like self-stimulation, appears to be reinforced by its sensory consequences. Self-injurious behavior appeared to be most often related to particular antecedents and/or consequences as demonstrated by the study from Wieserler and associates (1985) which involved the rating of consequences of self-injurious behavior of sixty severely and profoundly disabled individuals by residential staff. It was found that thirty percent of self-injurious behavior was generally followed by staff attention, thirty-eight percent led to escape and that another thirty-two percent was not related to observable consequences.

On the other hand Trudel (1982) studied the antecedents associated with the behavior in Montreal institution. He found that thirty-three percent of the behavior was related to frustration, thirty-two percent to refusal of a demand, twenty-four percent to no particular circumstance, and twenty percent to anger In addition, it appears that there are other significant environmental influences on self-injurious behavior. Factors such as territorially, ambient noise, adaptive clothing, level of peer communication ability, dominance

hierarchy, and climate control have been reported to affect the behavior (Fulcher, 1984). These study suggest that self-injurious behavior may be linked to several sources of motivations. In fact Shroeder and associates (1980) suggested after analysis of self-injurious behavior taxonomies that there are two subclasses of the behavior: one social and one non-social (however, it seems that the social category is the most common).

It appears that a major confusion associated with the definition, purpose and domain of self-injurious behavior remains to this day (Schroeder, Mulick & Rojahn, 1988). Nonetheless, self-injurious or self-destructive behavior, often referred to as self-mutilation or self-directed aggression, can be one of the most extreme types of maladaptive behavior. It consists of repetitive and persistent responses by individuals that cause injury or potential injury to their own bodies. Specific forms of self-injurious behavior reported in the literature include several types: self-striking (for example, face slapping and head banging), biting various body parts, pinching, scratching, poking and pulling body parts. Other forms of behavior sometimes included in the self-injurious category are repeated vomiting or vomiting and reingesting food (rumination), and consuming non-edible substances (e.g., pica, eating objects such as cigarettes, or coprophagia, eating feces) (Favell et al., 1982). Varying intensity of the behavior has been reported in individuals with severe disabilities and as it will be seen in the next subsection, the behavior is also present in other populations.

A) Prevalence and distribution of stereotyped behavior

Stereotyped behavior is a behavior commonly found in the population of individuals with severe disabilities. People labelled as autistic, mentally handicapped, or sensory handicapped are at risk of developing stereotyped behavior (Jones, 1988). However, the behavior is also found in young infants and animals reared in isolation (Berkson, 1983). Up to forty-seven dissimilar types of stereotypic behavior were reported to occur in babies: the more prevalent being two forms of body rocking (MacLean & Baumeister, 1982)

Because of its presence across species, some view the behavior as a form of adaptive behavior necessary to the development of motor and cognitive structures. For example, Berkson (1983) who reviewed the literature on stereotyped behavior reported that it was hypothesized that body rocking accelerated motor development, modulated arousal level and served to maintain perceptual and cognitive structures. For some, the behavior is viewed as transitional to more complex behavior patterns (MacLean & Baumeister, 1982). In fact, there is growing evidence that direct stimulation of the vestibular apparatus enhances motor development of preambulatory, normally developing and developmentally delayed children (MacLean & Baumeister, 1982; MacLean & Arendt,1986). For example MacLean and Baumeister (1982) provided "semi-circular canal stimulation" for ten minutes daily for two weeks to four developmentally dalayed babies using a motor-driven chair rotating the children. They noted motor and reflex changes and changes in stereotypic responding. Thus, it may be, according to the authors that stereotyped behavior played a role in normal development, but it should be noted that abnormal

stereotypic behavior may differ from the behavior found in normal children in terms of intensity, persistence and compulsive and obsessive nature (MacLean & Baumeister, 1982)

According to Jones (1988) early prevalence studies indicated that stereotyped behavior was more common in people who lived in institutions. It was found that up to sixty percent of mentally handicapped individuals who resided in institutions displayed some forms of stereotyped behavior. Similar results are reported in Rincover (1986). However, according to Rojahn (1986), a similar rate was found in a nation wide survey in the Federal Republic of Germany among noninstitutionalized mentally handicapped. Sixty-two percent of individuals with mental handicaps were reported to display stereotyped behavior suggesting that the behavior function is relatively independent of the environment. This rate was slightly higher (65%) for individuals who were also displaying self-injurious behavior (Rojahn, 1986).

Self-injurious behavior, like stereotypic behavior, is also present in individuals other than those with severe disabilities. In fact, books have been devoted to the topic of self-injurious behavior within other populations (see Ross & McKay, 1979). For example, it was reported that amoung children that were physically battered, as many as forty-six percent were reported to engage in self-injurious behavior such as cutting, slashing, bruising, burning self and so on, and the incidence rate was even found to be higher among victims of incest (de Young, 1982). Also, self-injurious behavior was found to occur in seven to seventeen percent of normal babies (Fulcher, 1984; Gunter, 1984). According to Gunter (1984), when behavior occurs in normal babies it

develops between the seventh and eighth month and generally disappears by five years.

Self-injurious behavior has been reported to occur in from eight to fourteen percent of institutionalized mentally handicapped individuals (Griffin, Williams, Stark, Altmeyer & Mason, 1986; Rojahn, 1986; Schroeder, Schroeder Smith, & Dalldorf, 1978) and as high as forty percent for severely emotionally disturbed children (Gunter, 1984; Fulcher, 1984). The behavior was reported to be displayed by six percent of autistic people (Trudel, 1982). The most frequent type of self-injurious behavior reported is head-banging and was reported to occur in nineteen percent of individuals displaying self-injurious behavior (Trudel, 1982). However the most often reported type of self-injurious behavior might depend on the population involved. For example, head-banging and eye-poking are the most prevalent form of self-injurious behavior reported in the literature related to blind individuals (Longo, Rotatori, Kapperman & Heinze, 1981).

According to Gunter (1984), the more mentally handicapped the child, the more frequent and severe the self-injurious behavior. In a State wide survey, it was found that eighty-nine percent of those who displayed self-injurious behavior were severely or profoundly mentally handicapped (Griffin et al., 1986). It is important to note, however, that not every individual with severe or profound mental handicaps display this type of behavior. Self-injurious behavior is often accompanied by other forms of stereotyped behaviors, by aggression, by communication deficits and by neuropathology (Fulcher, 1984; Gunter, 1984). In one study, children with self-injurious behavior tended to be younger and institutionalized longer and the severe cases

had a longer history of chronic self-injurious behavior (Schroeder et al., 1978). According to Fulcher (1984), the higher the rate of self-injurious behavior, the more the chance of permanent damage to the body and the greater the interference with learning and development.

B) Etiology

Several motivational sources for stereotyped behavior have been suggested. However, it seems that most of the proposed explanations deal with the most extreme form of stereotyped behavior or self-injurious behavior. In general, the explanations for self-injurious behavior do not necessarily correspond to the explanations of self-stimulation although some explanations applied for both behaviors. For a complete review of the etiology of self-injurious behavior the reader is referred to Carr (1976). The hypotheses described in this article are: (1) the positive reinforcement hypothesis, (2) the negative reinforcement hypothesis, (3) the psychodynamic hypothesis, (4) the organic hypothesis, and (5) the self-stimulation hypothesis. Some of the explanations proposed are related to the medical orientation, some to the behavioral orientation and some to the psychological or psychodynamic orientation.

The explanations proposed for stereotypic behavior include the self-stimulation hypothesis described by Carr (1976). The explanations for self-stimulation can be divided into two major categories: (1) internal drive, and (2) environmental explanations (Jones, 1988). Included in the internal drive category are explanations such as frustration, tension, movement drive, and arousal. Other explanations, described elsewhere and related to the arousal hypothesis, could be included in this category (Rincover, 1986).

Explanations such as overarousal, underarousal, alternating states of arousal, and compensation for dysfunctioning connections between the vestibular system and cerebellum or brain stem have been proposed. Explanations such as social deprivation and superstitious conditioning as well as other explanations related to learning theory are included under the category "environmental explanations".

Perhaps the most popular explanation of stereotyped behavior is that the behavior is a manifestation of some form of internal drive state (Jones, 1988). The behavior is viewed as "modulating general arousal". Individuals who are understimulated would engage in the behavior to increase their level of arousal while individuals who are overstimulated would attempt to reduce their arousal level by engaging in the behavior. Thus the relationship between arousal and stereotyped behavior is conceived as a U-shaped curve (Jones, 1988). Although appealing, this explanation has been criticized for its circularity (Jones, 1988; Rincover, 1986).

Recently, a new explanation was proposed. Self-stimulation is viewed as an operant behavior maintained by its sensory consequences (for example, its visual consequence) (Rincover, 1986). This explanation has received much support (see review under subheading "sensory channel" in this section). A refinement of this explanation was more recently suggested in the literature. Lovaas and associates (1987) proposed that self-stimulation is an operant response "whose reinforcers are automatically producing interoceptive and exteroceptive perceptual consequences"(p.45). That is, the perceptual stimuli would be automatically produced by the behavior. The stimuli may be directly generated by the movements involved in the behavior

or may result from a particular arrangement of external stimuli produced by the behavior in interaction with the environment. The term perceptual reinforcement was preferred to sensory reinforcement because "afferent stimulation during repetitive movement comes from multiple receptors and is relatively complex and patterned" (p.48).

Thus, many explanations of stereotyped behavior were proposed. Although some explanations have received more support than others, no single explanation may account for all forms of the behavior. As stated in Jones (1988) "an examination of the literature leads only to the conclusion that they (the theories) are all, in part correct" (p.177). The motivations for each form of stereotyped behavior including self-injurious behavior may be different for each individual and each behavior may have multiple motivations. Thus, as suggested by Durand and Carr (1985), in reference to self-injurious behavior, it would be important to identify the motivational conditions associated with a particular behavior. ABC analysis and functional assessment are used for this purpose (Devany, 1989). Also, assessment tools such as a behavioral-analytic questionnaire which identify four functions of self-injurious behavior in the mentally handicapped (Hauck, 1985) and the Motivation assessment scale (MAS) were recently designed to facilitate the task (Durand & Crimmins, 1988). The MAS is a brief questionnaire designed to "identify those situations in which the individual is likely to behave in certain ways". Once the questions have been answered, a score is obtained for each of the motivational categories: sensory, escape, attention, and tangibles (food, toys,

activities), and the dominant motivational variable is identified from which an appropriate corresponding treatment may be designed.

Treatments

Many behavior modification techniques to reduce stereotyped, and self-injurious behavior have been studied and several have been found to be effective. Favell and her associates (1982) and Gorman-Smith and Matson (1985) reviewed the literature on stereotyped and self-injurious behaviors. They found that the techniques vary in terms of intrusiveness or aversiveness. Most of the techniques used with self-injurious and stereotyped behaviors are also applicable to other types of behaviors. Some are very positive and some very aversive. According to this authors, differential reinforcement of other behavior (DRO) (reinforcing for not displaying the target behavior for a preset interval) has been used effectively. Differential reinforcement of incompatible behavior (DRI) as well as differential reinforcement of low rate of responding (DRL) have also been employed to reduce self-injurious behavior. However, in most cases differential reinforcement was used along with another intervention. Extinction and time-out were also found effective. Negative practice (repeating the inappropriate behavior several times contingent on its presence) ~~in the inappropriate~~ has been used (Secan & Egel, 1986). Overcorrection has been widely used and found very effective alone or in combination (Gorman-Smith & Matson, 1985).

Overcorrection has been found to be effective and also it appears to have been judged as acceptable by parents (Pickering & Morgan, 1985; Tarnowski, Rasnake, Mulick & Kelly, 1989). In Tarnowski and associates' study (1989), interventions such as differential

reinforcement and stimulus control were rated as more acceptable than punitive interventions and the acceptability of the intervention varied as a function of the severity of the behavior. However, overcorrection (a punitive technique) was preferred by parents over physical restraint and shock. Similar results concerning the acceptability of overcorrection were reported in Pickering and Morgan (1985).

A) Aversive interventions

Aversive techniques such as the following applied contingently on the occurrence of the stereotyped responses have been used: electric shock, physical restraint, slaps on the hand (Durand & Carr, 1987), or on thigh (Rincover, 1986), squirting lemon juice in the mouth, water mist spray in the face, ammonia, facial screening (placing a cloth over the eyes or the face for brief period), or icing (placing an icebag on the face or arm), air splints (placement of air bags, typically used as a temporary cast on limbs as a means of physical restraint (Gorman-Smith, 1985). The use of restraints appears to have been the first method used to eliminate self-injurious behavior (Longo et al., 1981). The individual was simply tied to a bed, table or other object. The behavior was obviously not emitted but, as a result, the individual often showed signs of "demineralization, shortened tendons, and muscular atrophy due to non-use of the limbs" (Longo et al. 1981; Fulcher, 1984).

These aversive techniques, however are normally considered too intrusive or ethically and legally controversial to be utilized in a school setting. In addition, logistical problems of implementation are often encountered with several of these techniques. Among the legal

requirements, usually the non-aversive alternatives must be exhausted first prior to applying techniques considered more intrusive, alternative behavior must be built, and consent from parents must be obtained (Alberto & Troutman, 1986; Martin & Pear, 1988). Nevertheless, this area is still highly controversial and different organizations take on different positions relative to the use and acceptability of certain techniques (Association for Retarded Citizens, 1987; Guess & Turnbull, 1987; Lovaas & Favell, 1987; Sobsey, 1987). Decision models have been designed to facilitate the choice of the appropriate intervention (see Gaylord-Ross, 1980; Donnelan, Lavigna, Zambita & Thvedt, 1985; Evans & Meyer, 1985).

B) Pharmacologic management

Another class of intervention used by medical personnel is the pharmacologic management of self-mutilation in the mentally handicapped population. This area of research was mostly based on case studies instead of controlled studies (Lapierre & Reesal, 1986). The results concerning the effect of most medications used in an attempt to reduce aggressive and self-injurious behavior are mixed. Some reported short term improvements following administration of opiate antagonist such as naloxone (Sandman, Datta, Barron, Hoehler, Williams & Swanson,1983; Richardson & Zaleski, 1983), suggesting a possible role of endorphins system in self-injurious behavior. However, naloxone was not recommended as therapy by Richardson and Zaleski (1983) because the drug seemed to have produced a drug withdrawal state in the patient under study. Others reported the effectiveness of baclofen (medication derived from GABA an amino acid present in the brain and the spine) on the severe and multiple form of

self-injury of one psychotic adult (Rousselot & Perrot-Gallien, 1984). Fenfluramine (an antiserotonergic agent structurally similar to amphetamine but having a different mechanism of action) was also found effective in different degrees in reducing stereotypies and other behaviors of ten autistic children (Campbell et al. 1986). However, in another study, clients exhibiting self-injurious and stereotypic behavior were rated in terms of response to sedative-hypnotic medication (Barron & Sandman, 1983). Sixty-eight percent of the clients with both stereotyped and self-injurious behavior were either resistive, combative, restless, uncooperative, after treatment with sedative-hypnotics. Thus, cases where medication was not effective or the side effects were serious have been reported. After a review of the literature on the use of major tranquilizers, stimulants, antimanics, and other drug therapy, it was concluded that the evidence for the efficacy of drugs in the treatment of self-injurious behavior in the mentally handicapped is not convincing (Basquin, 1984; Singh & Millichamp,1984).

Perhaps the future of pharmacological management of self-injurious behavior lies in a combination of treatments. For example, Durand (1982) was the first to systematically document the utilization of medication (haloperidol) along with a behavioral intervention (mild punishment). Neither treatment alone produced the desired effect. However, the combination of the treatments was very effective in reducing self-injurious behaviors. For more information related to drug management of self-injurious behavior, the reader is referred to an article by Baumeister, Frye and Schroeder (1984) on

neurochemicals correlates of self-injurious behavior and a review by Lapierrre and Reesal (1986).

C) Stimulus control

Another class of treatment procedures that is promising for the school setting or other community-based environments, is based on the principle of stimulus control. It means that some behaviors are more prevalent in some situations or environments than others. In fact there are now several authors that advocate ecological and antecedent variations (Donnelan, Lavigna, Negri-Schoultz & Fassbender, 1988; Gast & Wolery, 1987; Wehman, 1985). For example, some writers described three types of antecedent changes that may alter the behavior in a positive way: change in the task difficulty, environmental arrangement, and response interruption (Evans & Meyer, 1985). Thus general changes in the social and physical environment may alter behavior in a positive way. However, specific changes associated with the manipulation of stimulus related to the presence of behavior problems can also be made. By rearranging antecedent stimulus conditions associated with the presence of the target behavior, it is possible to obtain the desired effects on the behaviors of concern.

The utilization of stimulus control is closely linked to assessment procedures. Functional assessment of the behavior needs to be conducted in order to identify the stimulus or situations responsible for the presence and maintenance of the target behavior. The reader is referred to Donnelan, Mirenda, Mesaros and Fassbender (1984) for more detailed information in this area. This approach to behavioral treatment is exemplified in a study by Carr and Durand (1985). In this study involving four developmentally disabled children, it was first

found that the level of task difficulty and low level of adult attention were the discriminative stimulus for aggressive behavior, tantrums, and self-injury. In the second phase of the experiment the children were taught to get attention or assistance verbally from adults by using sentences related to the function of the behavior such as "am I doing good?". The treatment which involved the differential reinforcement of functional communication produced a reduction of the target behaviors for the four children. Similar studies stressing the need of assessing the motivational conditions of stereotyped behavior and self-injurious behavior, were published (Carr, Newson & Binkoff, 1976; Demchak & Galle, 1985; Repp, Felce & Barton, 1988; Weeks & Gaylord-Ross, 1981). Some researchers cautioned, however, that limitations of stimulus control procedures remained because specific stimulus events are seldom specific especially for behavior such as aggression (Gardner, Cole, Davidson & Karan, 1986). Durand (1980) also demonstrated that self-injurious behavior in one person could be associated with more than one stimulus condition responsible for the behavior.

Role of sensory stimulation

As mentioned in the section "nature of stereotyped behavior" several researchers see a role of stimulation in the behavior and that is why the term self-stimulation is used. There is increasing evidence for the role of stimulation in stereotyped behavior.

Some researchers have found that providing high environmental stimulation such as sound effects and varied light can reduce the stereotyped behavior of some autistic children (Frankel, Freeman, Ritvo & Pardo, 1978). Others found that vibratory or visual stimulation

could reduce self-injury (Taylor & Chamove, 1986). Sensory-integrative techniques, including slow, repetitive rocking in a hammock, deep-pressure stimulation with a vibrator, or hands on massage, was also found effective in reducing self-stimulation and self-injury such as head slapping, hitting and biting hands for four profoundly and multiply handicapped individuals with long history of self-injurious behavior (Wells & Smith, 1983). Similar techniques were used successfully with a twenty-eight year old non-ambulatory profoundly disabled person (Bright, Bittick & Fleeman, 1981) and on the rocking behavior of three severely disabled persons (Banadonna, 1981). Cullen (1987) also reported that massage including holding, touching and rocking was used effectively to reduce the serious self-hitting of a child when every other behavioral management technique had failed. Thus, there is direct and indirect evidence suggesting a role of sensory stimulation in stereotyped behavior.

It appears that some type of stimulation may also be implicated in the acquisition and maintenance of aggressive behavior. Hayes, Rincover, and Volosin (1980) demónstrated this in using a similar methodology than the well known Bandura's study on imitation in which a "Bobo doll" is used. In this two phase study, the forty-eight preschool children involved were shown (a) no film, (b) a film of a limited-movement Bobo doll being struck and (c) a film of free-moving Bobo doll being struck. In the second phase of the study, the children were given access to a limited-movement Bobo doll or to a free moving Bobo doll where the frequency of aggression was monitored. It was show that sensory consequences (free moving bobo doll) produced greater effects on both imitative and non-imitative aggression. The

authors suggested that modeling was primarily influencing the acquisition of aggressive behavior, but sensory reinforcement determined its maintenance. Thus, this study adds evidence of the role of a type of external stimulation in the presence of behavior problems.

Although stimulation appears to play an important role in stereotyped behavior and perhaps in aggressive behaviors, other factors seem to be involved. For example, in one study it was shown that having control over the element providing sensory stimulation may be an important component of stereotyped behavior (Buyer, Berkson, Winnega & Morton, 1987). In this study nine children with severe or profound disabilities displaying stereotyped behaviors were presented with a choice of three rocking chairs: one that could rock freely, one stationary chair, and one under the experimenter's control. The children significantly chose the chair they could control. The authors of this study interpreted the results as showing that stereotyped behavior involved at least two processes: control and stimulation.

Others have suggested that providing external stimulation has reinforcing proprieties (Hayes et al., 1980). For example, Wolery (1978) used sensory stimulation similar to that received during self-stimulation such as patting legs, contingent on the delivery of the appropriate response. Similar results were obtained by Rincover, Newsom, Lovaas and Koegel (1977) and Wolery, Kirk and Gast (1985). In fact, sensory reinforcement has been studied since the fifties by learning theorists working with animals, and it has been demonstrated that they could act as reinforcers with children (see Murphy, 1982 for

a complete review). However, according to Murphy (1982) a close relationship between stereotyped behavior and sensory reinforcement has only recently been established.

A) Role of sensory channels

Another group of studies have focussed on particular sensory channels or modalities instead of general stimulation. This group of studies has used sophisticated techniques of stimulus control discussed previously. In other words, in these studies, the investigators have been closely relying on careful assessment and the utilization of the results in programming for the treatment.

Rincover, Cook, Peoples, and Packard (1979) assessed the conditions which maintained the self-stimulatory behaviors of four autistic children. Once these conditions were identified, they were able to decrease self-stimulation by providing corresponding toy play. In the first phase of the research, the investigators used sensory extinction procedures, or the masking of the hypothesized source of stimulation, and a withdrawal design (A-B-A-B) to identify reinforcers maintaining self-stimulation. They systematically removed auditory, proprioceptive (i.e., produced within body tissues or muscles), or visual consequences (in order to remove the proprioceptive consequences, a small vibrator was attached to the arm). For example, it was thought that spinning a bowl on a table was maintained by its auditory consequences for one of the children. To verify this hypothesis, the table was covered with a hard carpet to eliminate the noise made by the bowl without preventing it from spinning. The spinning of the bowl was rapidly extinguished in the treatment condition and returned to the initial level when the condition was

withdrawn. This result is consistent with the hypothesis that the behavior was maintained by its auditory consequence. In the second phase of the experiment, the sensory channel isolated in phase 1 served to identify the appropriate sensory reinforcer for new appropriate toy play. For example, the child who spun the bowl was required to play with a music box. The results showed that not only did self-stimulation remain low for three out of four subjects but also that the appropriate toy play was maintained months after the treatment was withdrawn in absence of external reinforcers for play behavior.

Rincover and Devany (1982) also successfully applied the sensory extinction procedures to eliminate stimulation from head-banging and face scratching. In using a hat and placing foam on the walls and the floor for head banging and in using gloves for face scratching, they obtained immediate and substantial reductions of self-destructive behavior; the gains were maintained for months after the withdrawal of the treatment. Favell, McGimsey, and Schell (1982) provided alternate sensory activities to reduce self-destructive behaviors (hand-mouthing, eye-poking, and pica or the ingestion of inedible objects) in three profoundly disabled individuals by giving toys that provided corresponding sensory stimulation. The three subjects' behaviors were eliminated then replaced by self-stimulation with the toys. Thereafter, external reinforcement of more appropriate play with the toy increased conventional toy use and decreased self-stimulation. Sensory extinction has also been used successfully to reduce ritualistic motor behavior (Rincover, Newsom & Carr, 1979) and stereotypic vocalization (Aiken & Salzberg, 1984). Thus, these studies show that,

by identifying the sensory channel associated with the behavior and providing corresponding stimulation in a more appropriate form, substantial treatment gains can be obtained.

However, the question of whether or not the specific sensory channels of stereotyped behavior should be identified prior to designing an appropriate and matching treatment remain controversial. Equivocal results have been obtained and some researcher have been able to reduce similar forms of stereotyped behavior using different sensory modalities (Taylor & Chamove, 1986). For example, in Taylor and Chamove's study (1986) both vibratory stimulation (massager) and visual stimulation (flashing red light) were equally effective in reducing self-injurious behavior (face hitting and picking skin).

In general, however it appeared that the sensory channels involved may need to be identified at least for some forms of stereotyped behaviors. For example, Aiken and Salzberg (1984) showed that behavior such as hand clapping and dropping objects were relatively unaffected by the utilization of white noise to mask the sensory consequence while stereotypic vocalization were substantially reduced suggesting that a sensory match was necessary. Also, Rincover and associates (1979) showed that similar ritualistic behavior in different individuals could be maintained by different sensory consequences and could be reduced only by providing corresponding treatment. However, in another study, it was found that perhaps the topography of the behavior was an important dimension (Maag, Wolchik, Rutherford & Parks, 1986). In Maag and associates' study, sensory extinction was used and it was found that dissimilar behaviors

remained unchanged while topographically similar behaviors were concurrently decreased following the application of the treatment procedure. Thus, although there is much support for the role of sensory channels in the presence of stereotyped behavior, there are many aspects of this area of study that remained unclear. As suggested by Lovaas and associates (1987) in their article on perceptual reinforcement, part of the problem is probably related to the fact that many sensory channels may be implicated in one type of behavior while only one channel may be involved in another type.

In the next chapter, the literature related to exercise and its different applications including its use with individuals with intellectual disabilities is reviewed. As it will be shown, exercise has been found to reduce stereotyped and other behaviors. Perhaps that the stimulation provided by exercise play a role in the reduction of the target behaviors.

CHAPTER IV

EXERCISE, FITNESS AND APPLICATIONS

The topics of exercise and physical fitness has received considerable attention in recent years perhaps because of its association with a reduced risk for cardiovascular disease and with improvement in quality of life (Martin & Dubbert, 1982). In fact, "the importance of good cardiovascular conditioning for general health and well being is extensively recognized" (Fernhall, Tymeson, & Webster, 1988, p.12). In this section of the literature review, the biological variations associated with exercise are described. The general effects and applications of exercise are also described prior to addressing the topic of exercise as a form of behavioral treatment.

The term exercise is vast and includes many physical activities that could be classified into different categories. The term applies to weight training, games, sports, dance, aquatics, and many more physical activities. Exercise is closely associated with the term aerobic fitness and physical fitness, but the latter are narrower in scope. Forms of exercise which increase the endurance of the pulmonary and cardiovascular systems are known as aerobic. Thus activities such as running, swimming, cycling, walking, rowing qualify as aerobic. On the other hand, weight lifting, callisthenics, isotonic and stop and go exercises like tennis, golf and bowling do not qualify because they do not typically increase cardio-pulmonary endurance (Ledwidge, 1980). Halle, Gabler-Halle and Bemben (1989) defined aerobic fitness: as "the ability to take in, transport, and utilize oxygen" (p.34). On the other hand, a person who is physically fit "possesses the motor variables of strength, power, agility, endurance, balance,

speed, anticipation, and general coordination" (Moon & Renzaglia, 1982, p. 271). According to these authors the major components of physical fitness are (a) lean body weight (without excessive adipose tissue), (b) cardiovascular-respiratory efficiency (delivery of oxygen to body tissues), and (c) neuromuscular efficiency (capacity to move through a full range of motion). Most physical activities provide some aerobic fitness, but some are aimed at further improving muscular strength, endurance, and flexibility.

Biological aspect of exercise

During and after exercising, somatic activities are taking place. Around two thirds of the energy spent by a normal person is for the metabolic system (basic somatic functions). The other third of energy is spent by general activity and exercise (Atkinson, Atkinson, Smith, & Hilgard, 1987). Basically, exercise helps metabolic functioning and burns calories. During exercise there is an activation of the cardio-pulmonary system and complex metabolic and biochemical changes that take place. These changes are only beginning to be understood. In general, the sympathetic system prepares the organism for the production of energy while the parasympathetic system works to conserve the energy and bring the organism to a normal state. Thus, during exercise both systems are likely to work in orchestration.

According to Euler (1974), physical work involves a number of regulatory mechanisms. Some of these mechanisms come into action even at low work loads while others are more noticeable as the work loads become more strenuous. Euler states that the sympatho-adrenal system is involved in the body's response to exercise and takes part in homeostatic functions, such as the maintenance of blood pressure, and

should facilitate or even make possible the use of reserve fuel. Euler in reviewing the literature presented the evidence of the participation of the sympatho-adrenal system. During an increase in physical activity, there are three important physiological responses: First there is an increase in activity of the sympatho-adrenal system (adrenaline from the adrenal medulla affects bodily functions differently than other sympathetic neurotransmitters). Second there is an increase in release of epinephrine and norepinephrine (catecholamines). The relative excretion of epinephrine depends on the type of work. For example, according to Euler epinephrine was found to be higher in marathon runners than in ski racers, and wood cutters. Third, there is a continuous fall of blood glucose and muscle glygogen (during prolonged exercise). Others have reported a reduction in resting muscle action potential following exercise training as an explanation for tension relief, and also an increased reserve of steroids available to counter stress as a result of increased adrenal activity (Folkins & Sime, 1981). There is also increasing evidence that the level of *B*-endorphin is increased following exercise in animals (Imai, Stone, Woolf, & Liang, 1988; Waldrop, Bielecki & Geldon, 1987) and in humans (Surbey, Andrew, Cervenko & Hamilton, 1984; Viswanathan, Van Dick, Graham, Bonen & George, 1987;). *B*-endorphin is a morphine like substance derived from the same precursor hormone as adrenocorticotropic hormone (ACTH) from the anterior pituitary. Endogeneous opioids are important in the perception of pain and increased in response to a variety of stresses (Imai et al. 1988). Also, according to Pert and Pert (1977) there is anatomical evidence (the presence of cell bodies and terminals in specific parts of the brain) to

suggest an important modulatory role of enkephalins in affective states, pain perception, autonomic functions as well as motor behavior. According to Terenius (1982) consistent findings related to a role of endorphins in mood and attention have been obtained.

The release of *B*-endorphin after exercise in humans has stimulated many theories. Because of the similarities of *B*-endorphin and opioids, many scholars see a role of endorphin in the control of pain during strenuous exercise (Imai et al., 1988). According to Folkins and Sime (1981), the well-being phenomenon following fitness training has also been linked to the release of these morphine like chemicals synthesized in the brain and the pituitary gland. However, according to Surbey et al. (1984), "the only certain connection that can be made between endorphins and exercise is the rise of serum *B*-endorphin levels, which probably represents a part of the body's endocrine response to stress" (p.674). For more information on the role of endorphin in humans, the reader is referred to two book chapters: one by Pert and Pert (1977) and another by Terenius (1982).

Effects and applications of exercise

Exercising has become a major concern in modern society. Generally the use of exercise is being promoted in association with health, improvements in quality of life and psychological function, and a suggested reduction of cardiovascular morbidity and mortality (Martin & Dubbert, 1982). The practice of exercise is currently associated with (a) a reduction of body fat, (b) an increase in work capacity, and (c) an increase in high density lipoproteins cholesterol. These changes are hypothesized to help protect against coronary heart

diseases, lower back problems, depression and so on (Fernhall et al., 1982). This current belief has led to the application of exercise to many health problems and target populations.

The application and promotion of exercise is popular in behavioral medicine. However, according to Martin and Dubbert (1982), "despite its demonstrated and presumed benefits, exercise remains an experimental 'therapy' in many areas of interest to clinical and health psychologists" (p.1004). Because of methodological weaknesses in many of the available studies, it was difficult for Martin and Dubbert to separate effects. According to them, much of the evidence has come from anecdotal case studies and from correlational or "flawed experimental analyses that failed to demonstrate a causal relationship". This perspective is supported by Folkins and Sime (1981) who critically reviewed the literature on physical fitness training and mental health. They also have stated that much of the psychological benefits of fitness training, especially jogging, have been propagandized by the popular press.

Nonetheless exercise has been employed in the prevention and treatment of heart diseases, management of diabetes, control of obesity and the elimination of smoking (Martin & Dubbert, 1982). According to these authors, aerobics were found to increase cardiovascular efficiency and modified cardiovascular risk profiles in healthy, high risk and coronary patients. With obese people the change in weight and fat were small without concurrent caloric restriction. Exercise was an early form of treatment with diabetes and today it is used adjunctive with diet. It has the potential to increase metabolic control, decrease plasma insulin and improve insulin

sensitivity and glucose tolerance. In the case of smoking, there was an inverse relationship between smoking and habitual physical exercise, and anecdotal reports suggest that one often quits smoking when starting to exercise. However, it is not clear, according to these authors what type of and how much exercise as a treatment is needed in such special applications. Another problem is related to the lack of adherence to the exercise program by the patients (it should be noted however, that similar problems with adherence to exercise regimen are found with exercise in the general population).

Other applications are related to the use of exercise to alter psychological variables in different populations. Exercise has been used with psychiatric patients (Dodson & Mullens,1969), geriatric patients (Powell, 1974), depressive and anxious patients (Blue, 1979; Ledwidge, 1980), physically and emotionally disabled individuals (Schlenoff, 1980), and mentally handicapped individuals (Tomporowski & Ellis, 1984, 1985). Dependent variables related to personality and self-concept, cognition, perception, sleep, social behavior, mood and affect and work performance have been measured (Folkins & Sime, 1981).

According to Folkins and Sime (1981) the research on physical fitness training suggests that improvement in mood, self-concept and work were found. The evidence on its effect on cognitive functioning is less clear but light exercise seemed to bolster cognitive performance. For example, Gupta, Sharma, and Jaspal (1974) found that two to five minutes of step-ups for physical activities significantly increased (p >.01) the efficiency of mental work for fifty subjects between nineteen and twenty-one, while ten to fifteen minutes

significantly decreased it. The subjects were asked to perform addition, subtraction, multiplication, and division. Thus, perhaps the obtained results depend on the duration of the exercise session. In the studies reviewed by Folkins and Sime (1981) some studies have obtained changes in the measured variables while others have not. The dependent variables were measured using a variety of standardized achievement tests and other standardized measures of intellectual functioning such as the Wechsler Intelligence Scales. Studies that aimed at measuring changes on affect demonstrated consistent improvement. These investigations, with a primary focus on the study of depression, tension, moods, anxiety and well-being all showed improved outcomes. However, none of the designs were true experiments. On the other hand, the only personality trait that was positively affected by exercise is self-concept. Most studies of physical training and personality used Cattell's Sixteen Personality Factor Questionnaire which may not be sensitive to short term change. For example, only modest changes were obtained following physical fitness by Ismail and Young (1977) who were also looking for changes in body chemistry in addition to personality change.

Folkins and Sime (1981) stated that no conclusion could be reached regarding the effect of exercise on clinical syndromes such as depression and psychoses because of Hawthorne effects or effects created by the feeling of special handling of the experimenter rather than by the independent variable itself. More recently, however, a clear linear inverse relationship was found between mental disturbance measured in different ways and the intensity of physical activity at work and in spare time in a Finnish study where eight

thousand individuals were included (Malkia, Joukamaa, Maatela, Aromaa & Heliovaara, 1985). In this study men and women of all ages with mild mental problems were found to be more passive than people with no mental problems. However, because this is a correlational study, it is not possible to say if the physically passive way of life came before or after the onset of mental disturbance. Also, a third variable may be connected to the passivity of life or mental disturbance. Thus, the results in this area remain equivocal.

Exercise and intellectual deficiency

The topic of exercise within the population of individuals with mental disabilities has been related to the deinstitutionalization trend (McCubbins & Jansma, 1985) and to the general trend in the population to recognize the potential value of exercise in improving health and various psychological variables (Moon & Renzaglia, 1982). Also, perhaps this trend is related to the realization that mentally handicapped individuals of both sexes have been found to have excessive body weight compared to the norm (Emery, Watson, Watson, Thompson & Biderman, 1985; Fox & Rotatori,1982). The participants from these studies were from different settings, including institutions, and had different degrees of disability. Fox and Rotatori found that residential home residents had fewer weight problems than institutionalized individuals. Also they found that there was a higher proportion of moderately and mildly disabled individuals that were obese than severely and profoundly disabled individuals (Emery and associates' (1985) research also failed to support the findings of an inverse relationship between IQ and weight).

Most of the research in the area of physical activity and intellectual deficiency has concentrated on mildly and moderately mentally handicapped children of school age. Only recently have researchers started to look at the effect of physical and psychological variables on severely disabled individuals (McCubbin & Jansma, 1985). Research on the applications and effects of exercise with individuals with intellectual disabilities has taken three general orientations. The first focus is related to the search for techniques to teach and maintain physical activity with individuals with intellectual disabilities. The second orientation has focussed on the improvement of cardiovascular fitness. The third focus is related to the use of exercise as a form of treatment in an attempt to improve behavioral and psychological variables of children and adults with intellectual disabilities.

Training and maintenance

It is apparent that the area of research related to the training and maintenance of exercise behavior has been stimulated in part by the inclusion of provisions in The Education for All Handicapped Children Act of 1975, Public Law 94-142 and later by the Amateur Sports Act of 1978, Public Law 95-606. Public Law 94-142 included statements denoting that physical education must be provided to children with disabilities if provided to other children. P.L. 95-606 was to increase awareness and acceptance of athletes with disabilities (Winnick, 1990). Only recently, however, has the necessity of providing structured programming in this area for persons with mental handicaps have been advocated (Moon & Renzaglia, 1982).

The training of students with multiple disabilities, severe physical impairments, and severe cognitive or sensory impairments is, according to Moon and Renzaglia (1982), usually approached in a much different manner than it is with individuals with milder intellectual disabilities. Programs for these individuals begin with sensory stimulation, basic movement training, and body positioning and involve the use of special adaptive equipment and the direction of medical personnel. Nonetheless, it is clear that severely and profoundly handicapped individuals can learn various exercise behaviors (Tomporowski & Jameson, 1985). A peer-mediated exercise program was found to be successful with individuals with moderate and severe disabilities (Halle et al., 1989). A token economy was found to be effective during the training (Bennett, Eisenman, French, Henderson, & Schultz) and the Premack principle was used successfully for the maintenance of the exercise behavior (Allen, & Iwata, 1980). For more information in this area, the reader is referred to Winnick (1990) and to Seaman and Depauw (1989) on adaptive physical education and to Dunn, Morehouse, and Fredericks (1986) on the data-based training of physical activities involving individuals with severe disabilities.

Cardiovascular fitness

The topic of fitness in individuals with mental handicaps has received much attention. Until recently the research on fitness training was primarily comparing the fitness level of the mildly and moderately mentally handicapped with that of their normal peers. The fitness level of individuals with a mental disability was found to be generally inferior to that of nonhandicapped persons (Moon, &

Renzaglia, 1982; Andrew, Reid, Beck, & McDonald, 1979). Research in this area generally attempts to measure cardiovascular efficiency or other variables related to the cardiovascular functioning of individuals with disabilities (Campbell, 1973; Coleman & Ayoub, 1976; Schurrer & Weltman, 1985; Watkinson & Miang Koh, 1988).

One important issue in this area is related to the measurement used. According to Seidi, Reid, and Montgomery (1987) no study has established the validity of cardiovascular fitness testing with mentally handicapped individuals while many testing protocols are used by different researchers. These authors acknowledge that comparisons among studies are problematic and that data based validations are necessary. For example, different field tests of different duration have been used across studies. Thus, it may be that the difference obtained in fitness level may in part be related to error of measurement and/or to the lack of validity of the technique used. Therefore, caution is required in interpreting results in this area of studies.

In addition, it appears that many factors in addition to low aerobic capacity (largest amount of oxygen the body can use during a period of strenuous activity) may influence the poor performance of individuals with disabilities, such as, (a) running efficiency, (b) anaerobic involvement, (c) willingness to accept and endure the discomfort and pain of strenuous effort, and (d) the ability to pace oneself (Koh & Watkinson, 1988). For a complete review of the research on cardiovascular fitness for individuals with mental handicaps, the reader is referred to Fernhall, Tymeson and Webster (1988).

Psychological and behavioral variables

Folkins and Sime (1981) reviewed studies on mental retardation and physical fitness training from 1958 to 1977. According to these authors, children with mental handicaps demonstrated psychological improvement following different physical fitness training. In these studies, revised standardized tests such as the Weschler Intelligence Scales for Children, the Peabody Picture Vocabulary test, the Holtzman Inkblot Test and other tests were used. Other measures included observations of adjustment. However, according to Moon and Renzaglia (1982) there has been a failure to replicate some of the research on the relationship of fitness and other variables such as IQ, self-concept and peer relationship and there is no empirical evidence of a cause-and-effect relationship. In addition, more recent studies fail to replicate the findings from this body of research reviewed by Folkins and Sime (1981). For example, McCubbin and Jansma (1985) evaluated the effect of physical fitness training on the fitness performance, and adaptive behavior of moderately, severely and profoundly disabled institutionalized adults. Seventy-one subjects ranging from sixteen to fifty-five year old with a mean age of thirty-three were divided in four groups including a control group. A variety of aerobic and anaerobic exercises were included as part of the training program. Measures of fitness, seven scales of The Adaptive Behavior Scale of the American Association of Mental Deficiency and measures of independent ability (percent of task completion on task analyzed skills that the subjects could perform) were used by McCubbin and Jansma (1985). The measures of fitness showed statistically significant changes, however, no statistically significant

differences were obtained with any of the scales of adaptive behavior or with independent ability. Similar results were obtained by Tomporowski and Ellis (1984, 1985) who also included measures of intelligence. That is, no improvements were found in using scales of adaptive behavior and IQ. In their studies (one with mentally handicapped adults and one with adults with severe and profound disabilities) over a seven month period, exercise consisted of jogging, calisthenics, and circuit training three hours per day five days per week. The treatment produced statistically significant improvement in cardiovascular efficiency. These authors acknowledged that they might have used measures that were not sensitive to change in behavior.

Another group of studies focused on the effects of antecedent exercise on aberrant behavior. In fact, antecedent physical exercise as a form of treatment of self-stimulation is included in a book endorsed by The American Association of Mental Retardation (see Cipani, 1989). Exercise was shown to have a beneficial effect on many behaviors. For example, Watters and Watters (1980) found significant statistical decrease of the self-stimulatory behaviors of five autistic boys following eight to ten minutes of jogging. This study is the only one that used a group design in studying the effect of exercise on aberrant behaviors. Most of the studies in this area of research used single-subject research design. Using a AB design, Ohlson (1978) also found that exercise could have a beneficial effect on self-stimulatory behaviors commonly known as "blindism", of two blind children. The children were involved daily in a forty minute workout period (including a rest period). The results and the follow-up suggested that exercise

produced a substantial reduction of rocking. Another study has shown that not only exercise but other forms of motor behavior have an effect on behavior problems. Lancioni Smeets, Ceccarani, Capodaglia and Campanari (1984), used a withdrawal design (A-B-A-B) to study the effects of gross motor activities requiring physical efforts on the self-injurious tantrums of three individuals with multiple disabilities (including sensory deficits). In this study each individual was required to participate in several sessions of fifteen to twenty minutes duration to a total of one to three hours per day depending on subject's individual abilities. The gross motor activities were mainly vocational. For example, some activities were bending wire cords, hoses, ropes and storing them, inflating rubber tubes, cushions, and other inflatable objects by means of hand pumps. Also some objects were loaded onto a wagon and transported to a specified place. These activities are thought to provide a wide variety of sensory input (e.g., proprioceptive, kinesthetic, and tactile) without tiring the subjects excessively. The results showed that when the treatment was applied, all subjects had a definite decline in the self-injurious tantrums. For two out of three subjects, a reduction in duration of the tantrums was also found. Thus, this study along with the previous ones using exercise as an independent variable showed that some level of motor activity can have beneficial effects on self-destructive and self-stimulatory behavior. Other studies also reported a decrease in behaviors such as inappropriate vocalizations, repetitive movements and off task behaviors (Bachman & Fuqua, 1983). Reductions in behavior such as hitting, slapping, kicking, throwing objects, various forms of hyperactivity (McGimsey & Favell, 1988) and various other

maladaptive behaviors clustered in five categories such as aggression, self-injury, property destruction, non-compliance, disruption and stereotyped behaviors were obtained (Jansma & Combs, 1987). Reduction of disruptive behaviors (Allen, 1980) was also obtained following the administration of different types and amount of exercise.

a) Type of exercise

Most of the studies reviewed using exercise as a form of treatment used jogging as a specific form of exercise. Only two studies used aerobic dancing and mixed results were obtained (Bachman & Sluyter, 1988; Hoffman, 1987). Other forms of activities have also received some attention. Weight training was used in a pilot study in corrective therapy, but the results were inconclusive (Leighton, Cupp, Prince, Phillabaum, & McLarren, 1966). One study successfully used several forms of vocational activities requiring physical effort (Lancioni et al.,1984). One of the studies included multiple activities. A variety of apparatus were used such as exercise mats, bench, multipurpose weight machine, modified sit up boards and stationary bicycles in the study by Jansma and Combs (1987). Still another study allowed free activities on the grass (other than walking) (McGimsey & Favell,1988).

However, only a few studies have attempted to compare types of exercises and their effects on subsequent behavior problems. In one unpublished study, Greene (1987) compared the effect of judo training and socialization games on adaptive behavior and self-concept among adolescent males with behavior problems and mild mental handicaps. Both interventions were successful, but judo appeared to be the most effective intervention. Both interventions increased self-concept and reduced maladaptive behavior. In another comparative study, Kern

and associates (1984) compared the effects of mild versus vigorous exercise on stereotyped behaviors of three autistic children. An alternating treatment design was used to compare the influence of fifteen minutes of strenuous jogging and fifteen minutes of ball playing in which the subjects were passively required to throw and catch the ball. The results show that fifteen minutes of jogging was always followed by reductions in stereotyped behavior while fifteen minutes of ball playing had little or no influence on the children's subsequent stereotyped responding.

b) Amount of activity

It is not clear from the previous studies if there are differential effects produced on the target behaviors depending on the amount of activity required. In a study by Baumeister and MacLean (1984), three jogging conditions were compared. The gradual increase in distance from one to three miles per day (gradually increased over a six week period) was compared using a multiple treatment design (A-B-C-D-A) in decreasing both self-injurious and self-stimulatory behaviors of two adults with severe disabilities. It was found that the behaviors of concern gradually decreased over the six week period. Bachman and Fuqua (1983) also found that a gradual increase in the amount of exercise produced a gradual decrease in the target behaviors (e.g., behaviors such as inappropriate vocalizations, inappropriate and repetitive movements and off- task behaviors). Thus, in these studies it was shown that with an increase in the amount of exercise, more treatment gain was obtained. However, in these studies it is not clear if the gradual reduction obtained is related to the increase in duration of the treatment or to an increase in intensity.

c) Control of fatigue effects

In the studies reviewed so far, no control or little control of fatigue effects which could have accounted for at least a portion of the findings was applied. However, Kern and associates (1982) controlled this variable by concurrently measuring appropriate responding with self-stimulation. Not only did mildly strenuous jogging for five to twenty minutes (gradually increased during the course of the experiment) produce decreases in levels of self-stimulation of the seven autistic children involved in the study, but it also increased appropriate play and academic responding of the children. Thus, it appears that exercise has desirable, inhibiting effects on self-stimulation and self-injurious behaviors, but it can also facilitate appropriate responding which would have been expected to decrease if general fatigue accounted for the change. However, systematic replications of the studies on the effects of antecedent exercise on appropriate responding are needed. With the exception of Kern and associates' study (1982), in most studies reported on antecedent exercise, the fatigue variable was not systematically controlled. Also, it is not clear how exercise might have produced the reduction in the target behaviors. In at least two of the studies (Jansma & Combs, 1987; McGimsey & Favell, 1988) the reduction in behaviors obtained may be attributed at least in part to competing behaviors. For example, in McGimsey and Favell's study, two sessions of forty-five minutes each were administered daily. A one hour session was also included in Jansma and Combs' study. Thus, the subjects probably received more attention and reinforcement than they normally would in their daily routine. Also, fatigue probably played a significant role in

obtaining the results. From these studies, it is difficult to pinpoint any particular variable that produced the change in behaviors.

Also, in the studies related to antecedent exercise, several of the subjects, did not show improvement or showed little improvement following exercise (Bachman & Fuqua, 1983: Jansma & Combs,1987; McGimsey & Favell, 1988) while other students' inappropriate behavior increased instead of improving (Hoffman, 1987). It could be that the different results obtained in research using exercise as an independent variable are related to the type and function of behaviors included in the studies or perhaps to the subject's characteristics. For example, perhaps antecedent exercise is more effective with behaviors such as self-stimulation which are not associated with a particular antecedent or consequence. Perhaps that different types of exercise would produce proprioceptive, vestibular, kinesthetic and other forms of stimulation which would be compatible with, or similar to the stimulation produces in engaging in behaviors such as self-stimulatory behaviors.

Thus in this section, the literature on exercise was reviewed. Exercise was widely used with different populations for many goals related to physical and mental health. Exercise has also been used as a form of behavioral treatment especially with individuals with a mental handicap. However it appeared that it is not known so far if the intensity or the duration of the treatment is the important variable in producing a related behavioral reduction. Also it is almost impossible to infer possible causes of the reduction in part because fatigue, attention and other variables that might have been responsible for the change of behavior were only partially or not controlled. In addition it

is not known how long the effect of exercise on the behavior may be lasting. So far it appeared that no study so far have attempted to compare the effect of different types of exercise and no study has investigated the possible differences in behavioral changes that may be produced with different types of behaviors.

In the present study, aerobic dancing and jogging which are thought to provide different levels and types of sensory stimulation (especially vestibular, kinesthetics and proprioceptive stimulation) and to provide different movement patterns are compared. Several behaviors are selected to examine if differential effects are obtained depending on the behavior. The intensity and duration of the treatment are controlled, and measures of appropriate responding taken. First, it is hypothesized that both forms of exercise will be effective in reducing behaviors. Second, it is hypothesized that the activity producing a higher level of sensory stimulation will be more effective. In addition, it is hypothesized that behaviors such as self-stimulation associated with no particular external antecedent or external consequence, will be reduced to a greater extent than other behaviors associated with external events

CHAPTER V

METHOD AND PROCEDURES

This study used a single-subject, alternating treatments design to compare the relative effectiveness of antecedent jogging and informal aerobic dancing as techniques used to decrease self-stimulatory behaviors and other behaviors of two children with severe disabilities. The effects of these two treatment conditions on appropriate responding was also compared. The study took place in a self-contained classroom for children with autism.

Subjects

The subjects for this study were two individuals enrolled in a program for children with autism in Edmonton, Alberta. In order to locate children that could participate in the study, the two major school boards of the Edmonton district were contacted through field services of the Faculty of Education of the University of Alberta. The school boards were given criteria for the selection of each child. The children had to be selected according to the following criteria: (1) The student is registered in a school program; (2) the student has moderate or severe disabilities; (3) the student is ambulatory and is free of medical condition preventing participation in aerobic activities; (4) the student enjoys participating in physical activities; (5) the student remains in the same physical environment, such as the classroom, for approximation forty-five minutes in both the morning and the afternoon; (6) the student displays a high rate of self-stimulation (at least 1 per thirty seconds) such as finger twirling, body rocking, and so on; (7) the student displays inappropriate behaviors that do not appear to be related to external causes such as some forms

of self-injurious behaviors or disruptive behaviors; and (8) the student displays other inappropriate behaviors with clear antecedents and consequences. The local school boards recommended some schools where such individuals could be found. Several elementary and secondary schools with self-contained classrooms for children with severe disabilities were contacted. The children that potentially met the criteria (after a phone conversation with the teacher) were observed in their classroom. A number of children were observed who met some but not all the criteria. Both selected children were enrolled in the same class in a combined elementary and junior high public school of the Edmonton district along with five other young teenagers with autism and intellectual disabilities. The parents of these children were requested to sign consent forms (see appendix 1). Three assistants worked along with the teacher with these seven children.

Subject 1 was a fifteen year and nine month old boy at the time of the study. He lived in a group home with two other children with developmental disabilities. The boy exhibited congenital blindness, autism, echolalia, and severe mental retardation. He also demonstrated a severe communication disorder and behavior problems in addition to allergic reactions. He was taking twenty-five milligrams of Thiordneme per day. The child could pronounce few words, express his needs for food and drink, and respond to basic requests. He could also walk independently from one area of the classroom to another, but generally required assistance to move to different areas outside the classroom. Behaviorally, subject 1 displayed a high rate of stereotyped behaviors. The boy often resisted any

participation in activities by throwing himself on the floor, yelling, and engaging himself in aggressive behavior toward staff or in self-injurious behavior.

For both subjects the target behaviors and the appropriate responses were selected after consultation with the teacher and from observation of the videotape used for study. For subject 1 the target behaviors for the study were the following: (1) stereotyped behavior or any behavior that does not appear to serve any function other than serving as a form of sensory stimulation to the child, (2) self-directed behavior or behavior directed toward own body that may or may not be, depending on the context, providing self-stimulation, and (3) aggressive behavior or behavior directed toward other. The stereotyped behaviors were the following: (a) repetitive hand shaking or flipping, (b) entering finger in eye socket, (c) vocal noise or other vocalization other than yelling (does not include talking on request), (d) head shaking or rolling, (e) stomping feet or swinging legs, (f) body rocking back and forth, (g) placing inedible objects in mouth, or flipping, rolling, twirling object other than a ball from one hand to the next, and (h) loud breathing noise. The self-directed behaviors were: (a) Head banging against object, (b) hitting his head with hand or object, (c) hitting or slapping his body parts other than the head, and (d) biting his own arm or forearm. The aggressive behaviors were the following: Scratching hands, pulling hair, grabbing body parts or clothes. Screaming or loud yelling was also included as a target behavior.

For subject 1 the target appropriate responses were the following: (a) Taking an upright posture while not rocking or shaking

for five seconds (the child was usually not sitting upright and was often rocking on a chair), (b) attempting to sign or make a gesture, (c) bringing food or drink to the mouth, (d) responding verbally or gesturally to requests within five seconds, (e) pronouncing complete words or sentences, (f) walking independently toward a destination, and (g) reaching toward someone (requesting attention) without grabbing.

Subject 2 was a twelve-year and ten-month-old girl living in a group home with four other children with severe and multiple disabilities. The girl was diagnosed as autistic, having mental retardation, and exhibiting a profound delay in speech. She could follow multiple-step commands, pronounce few words, and expressed her needs by a combination of sounds and gestures. She had good self-care and social skills and enjoyed participating in physical activities.

For subject 2 the target behaviors were stereotyped behaviors such as (a) rocking her body back and forth, (b) placing her finger in and out of her mouth in a ritualistic way, (c) repetitively touching or pulling clothes, (d) swinging her legs, (e) tapping or twirling objects, and (f) twirling her hair with her fingers. The other dependent variables were: Vocalization other than talking, and placing her hand in mouth and sucking it while gazing in the same direction for five seconds (distracted).

For subject 2 the target appropriate responses were the following: (a) Pronouncing words, (b) responding to someone's request within five seconds, (c) carrying on with a task at hand (on task), (d) sitting upright (ready position) while waiting for instruction without

gazing in the same direction for five seconds, and (e) requesting something by making a gesture.

Materials

For this study, a portable heart rate meter, electrocardiogram (ECG) electrodes, a videocamera, a videocassette recorder with remote control, a portable tape recorder with prerecorded music tapes, and a timer were used. The heart rate meter was a Sport Tester PE 3000 manufactured by Polar Electro (Findland). The tester has the following features: lower and upper limit (alarm), memory for pulse, cordless receiver and transmitter, and an electrode belt. The ECG electrodes were disposable adhesive electrodes with silver chloride gel. The "Cleartrace 1700-030 multipurpose" electrodes were manufactured by Medtronic Andover Medical (Massachusetts). The color videocamera was a "Panasonic Proline WV 3180 Newvicon". The camera recorded the date, time, minutes, seconds, and hundredths of seconds at the bottom of the recorded picture. The timer used was a portable electronic timer with alarm. The prerecorded music tapes used for the study were home made tapes with songs for the warm up period (four minutes twenty-five seconds), the intense period (ten minutes) and the cool down period (four minutes eighteen seconds). The total duration of the recording was eighteen minutes and forty-three seconds. A second tape with a longer intense period (fifteen minutes) was also used.

Procedures

An alternating treatments design was used in comparing jogging and dancing. Ten minutes of jogging at a moderate pace and ten minutes of energetic movement along with music (aerobic dancing)

performed in the school gymnasium were compared. One condition was included in the morning while the other was included in the afternoon at the preselected time for each child. The presentation of the two conditions was counterbalanced for the morning and the afternoon. On some occasions only one condition was administered per day. Jogging and dancing were introduced in a counterbalanced order. Two similar conditions were never administered successively on a single day. When the similar sessions were administered next to each other, they were separated by a night of sleep. Also included in the treatment condition was a control condition in which no or little motor activity was performed but attention was given to the child (see controlled variables section). In addition, a baseline was taken at scheduled observation time with the exception that no treatment condition was administered prior to the observation period. The baseline consisted of four observation periods of 30 minutes each where the videotape was used to record appropriate as well as inappropriate behaviors.

During the treatment conditions, each child was taken to the small gymnasium in the school approximately five minutes before starting to walk around the gymnasium with the experimenter in order to warm up prior to going at a faster pace. Once the child arrived at the gymnasium, two adhesive ECG electrodes were placed on the child's back toward the heart. The electrodes were placed six inches apart, one on each side of the spine. The transmitter was snapped to the electrodes and the sport tester which was attached to the experimenter's wrist was activated. The lower and upper limit for the heart rate was also selected at plus or minus fifteen beats per

minute from the target heart rate for each child (see subsection intensity and duration for target rate). An alarm would be heard when the heart rate was outside these limits thus indicating the need to slow down or accelerate the pace. The tape recorder was activated at the preselected time. The electronic timer was started simultaneously with the tape recorder. During the first song, the child walked around the gymnasium with the experimenter. The heart rate was gradually raised toward the target as the end of the first song approached. The beginning of the second song indicated the beginning of the intense period. For most of the exercise sessions, both children were involved in the activity holding the experimenter's hand. Thus physical proximity between the experimenter and the children was present throughout the exercise conditions. Short pauses were distributed as required throughout the intensive session. During the jogging session, the child was running around the gymnasium holding the experimenter's hand or wrist. During the dancing session, the child remained in the center of the gymnasium and was involved in many rapid dance like movements along with the experimenter. For subject 1, the two hands were held and moved by the experimenter throughout the dance period .

The function memory from the sport monitor which keeps track of the child's pulse was activated at this time. The beginning of a song with a slower rhythm indicated the end of ten minutes of exercise. During the cool down period, the experimenter walked slowly around the gymnasium with the child prior to sitting down. The pulse rate from the memory was then entered on the data sheet divided into thirty seconds segments (see figure 1). At the end of the song, the

Figure 1

Data sheet for heart rate recording

Name:_____

Type of exercise:_____

Date	Starting time	Recording time	Heart rate data	Average &range
		030		
		100		
		130		
		200		
		230		
		300		
		400		
		430		
		500		
		530		
		600		
		630		
		700		
		730		
		800		
		830		
		900		
		930		
		1000		

Comments:_____

child was brought back to the classroom where he or she returned to the usual activity after a short rest on a chair. The alarm from the timer indicated the time to start thirty minutes of recording with the videocamera. The interval from the end of the ten minutes of exercise to the beginning of the observation period was ten minutes.

Controlled variables

A-intensity and duration

In order to control the intensity and amount of exercise provided by aerobic dancing and jogging, a technique based on one used by Bachman and Fuqua (1984) who used a target pulse rate and took the children's pulse at intermittent intervals was used. The pulse rate served as an indicator of when to slow down or accelerate the pace of the activity performed. A sport monitor was used to facilitate this task. The reading from the sport monitor was given every fifteen seconds and an alarm was heard if the pace was under the lower limit or over the upper one. A target pulse rate was selected for each subject. The target pulse rate was selected taking into consideration the age of the child and the resting pulse rate. It was set at fifty percent of maximum efficient heart rate.

The following formula was used to determine the target pulse rate:

$$\text{Target heart rate} = 50\% \text{ of } [\text{maximum heart rate} - \text{age} + \text{mean resting pulse}]$$

where the maximum heart rate equals 220 beats per minute (Bachman and Fuqua, 1984). The mean resting pulse was calculated using the sport tester for a duration of twenty minutes while the children were at rest laying on the couch in the classroom during the morning. For

subject 1 the resting pulse rate was 95 beats per minute and it was 88 for subject 2. The target pulse rate was 150 for subject 1 and 148 for subject 2. In addition to the pulse, it was ensured that both aerobic dancing, and jogging conditions had the same duration.

B-alternative behavior and reinforcement

In order to show that any effects possibly obtained in comparing the two conditions were not solely attributable to the creation of new behaviors or to the additional attention provided to the children, a control condition was introduced throughout the experiment. An activity that provided little or no motor activity was performed in the same environment (i.e., gymnasium). The heart rate was not monitored during this activity. For subject 1 this activity consisted simply in sitting with the experimenter while listening to the music (the same music that was used during the other conditions. On some occasions during this period, a short walk around the gymnasium was taken prior to sitting back on the bench. For subject 2 magazines were used. The child was encouraged to look at them while listening to music along with the trainer. However, the child remained free to walk around and look through the windows of the gymnasium. The control condition was introduced throughout the experiment in a counterbalanced way with the two other conditions. The duration and timing of the activity was the same as that for jogging or dancing (i.e., it was administered at the scheduled time for ten minutes in the morning or the afternoon). Also encouragement and praise were provided as much as possible in a neutral tone and were maintained constant throughout the experiment.

C-auditory stimulation

Music, which was part of the dancing condition, has been found to produce a reduction of certain types of self-stimulatory behaviors. Thus, to control this variable, music was also provided during the administration of jogging and the control conditions. Since music was present in all three conditions, its presence could not be considered responsible for any differences in responses among these conditions.

D-fatigue

In order to assess the possible effect of fatigue, the technique adopted by Kern and associates (1982) was used. Appropriate responding following the exercise conditions was measured in addition to the target inappropriate behaviors. The percent of appropriate responding served as an indication that the change obtained in behaviors was not associated with fatigue effects. Of course, the assumption was that the rate of appropriate responding would not decrease.

E-cardiovascular fitness

Although cardiovascular fitness is a complex concept and is associated with several variables, in this study this variable was partially controlled. The two conditions being compared were administered at a duration and intensity below or close to the minimum of what is recommended to obtain an improvement in cardiovascular fitness. Usually sixty-five to ninety percent of maximum heart rate is recommended for fifteen to sixty minutes per day three to five days a week. Most significant effects of conditioning are obtained in six to eight weeks (American College of Sports and Medecine, 1986).

Data collection

Each student returned to his or her classroom within the ten minute rest period following the exercise session. The next thirty minutes were videotaped. The activity being recorded and the variables possibly affecting measurement were written on a data sheet also including the time when recording and when the exercise session began, the type of exercise administered, the average heart rate during exercise and the behavior during administration of the condition (see figure 2). The use of the videocamera enabled multiple observations when necessary. Interval recording was used in recording the behavior from the videotape. This procedure was performed at the end of each day. The thirty minute observation period was divided into intervals of ten seconds. Within each interval, codes corresponding to each of the target behaviors were used. At the end of each ten second interval, the observer marked with a pencil line the appropriate codes for the behaviors being displayed within each interval. The percentage of occurrence of each individual code and the percentage of occurrence of all the codes together within the period of observation were computed. The percentage of the behavior together for the first and last fifteen minutes of the recording were also computed. For subject 1 codes were also assigned to other behaviors such as head banging and hitting self with a low rate of occurrence. These behaviors were not included in the calculation of the global percentage of occurrence. However, their percentage of occurrence was also computed individually. Every time these target behaviors were displayed, the code was written in colored ink on the appropriate interval corresponding to their time of occurrence.

Figure 2

Data collection for variables associated with each measurement period

Student name: _____

Date	Type of exercise	Time start/stop	Heart rate measure-ment	Behavior during exercise	Video recording time start/stop	Recorded activities-variables affecting measure-ment

Figures 3 and 4 present the data sheets used for the data recording for subjects 1 and 2. Appropriate responding was measured in observing the middle section of the sequence recorded on the videotape (i.e., starting at minute 8 of the recording). The middle section was used in order to verify if a difference between the first 15 minutes and the last 15 minutes of recording of every target responses would be obtained. The intervals division was also set at ten seconds. A checkmark was placed in the appropriate box on the data sheet corresponding to a ten second interval whenever any of the target appropriate responses occurred (see figures 5 and 5a).

Throughout the observation periods, inter-observer reliability checks were performed by a second observer using the same data sheets. Inter-observer reliability (%) was calculated on an interval by interval basis in using the following formula:

$$\% \text{ reliability} = \frac{\text{number of agreements}}{\text{number of agreements + number of disagreements}} \times 100.$$

Reliability checks were distributed throughout the study. The reliability checks were completed for the most frequent behaviors. For other behaviors the reliability is ensured by the use of videoequipment: Whenever necessary the tape was rewound and stopped where desired. Table 1 presents the results for both subjects.

Student : Subject #1
Date:_____
Time:_____

Code: H: repetitive hand shaking or flipping
E: entering finger in eye socket
V:vocalization other than loud yelling and talking on request
O:head shaking or rolling/body rocking
stomping feet or swinging legs/placing
inedible objects in mouth/loud repetitive breathing
noise/twirling,flipping,rolling object other than ball

B: biting own forearm or hand
Y: loud yelling

*to be marked directly

HB: head banging
HS: hit self
G: grabbing other

Minutes	01	02	03	04	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Seconds 10	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY
20	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY
30	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY
40	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY
50	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY
00	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	H BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY	HO BB VY
Total																														

Total:___ /180: ___%
1st 15 min ___ /90: ___%

2nd 15 min ___ /90: ___%

H:___ /180 ___%
E: ___/180 ___%

V:___ /180 ___%
O:___ /180 ___%

B:___ /180 ___%

Y:___/180 ___%

HB___ /180

HS___/180___%

add in empty spaces:
O=A: body rocking,legs swinging ___ /90 ___%
head rolling
=B: ventilation ___ /90 ___%
=C: object in mouth ___ /90 ___%
Proportion of B alone ___ / ___=___%

Figure 3
Data collection for inappropriate behaviors for subject 1

Figure 4

Data collection for inappropriate behaviors for subject 2

Student: subject #2
Date: _____
Time: _____

Code: A:-finger in and out the mouth
-tapping/twirling object
B -gazing (or 5 sec. with hand in mouth (distraction/off task)
C -body rocking,-legs swinging,-repetitively touch
or pull own clothes-twirling hair with finger
D -vocalization other than talking

Minutes	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Seconds 10	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
20	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
30	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
40	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
50	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
00	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
Total																														

1st 15 min ___/90 ___ %
2nd 15 min ___/90 ___ %
Total ___/180 ___ %

A: ___/180 ___ %
B: ___/180 ___ %
C: ___/180 ___ %
D: ___/180 ___ %

Student: subject#1
Date: _____
Time: _____

Appropriate responding
-upright posture while not shaking or rocking for 5 sec.
-sign or attempt to make a gesture
-reach toward someone/request attention by touching appropriately
-walk independently toward a destination
-pronounce a complete word or sentence
-bring food or liquid to mouth
-respond to request within 5 sec.

Minutes	01	02	03	04	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Seconds 10	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪																▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪
20	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪																▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪
30	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪																▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪
40	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪																▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪
50	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪																▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪
00	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪																▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪	▪ ▪ ▪
Total																														

1st 7 min ___/42 ____%
last 8 min ___/48 ____%

Total: ___/90 ___%

Figure 5

Data collection for appropriate responding for subject 1

Figure 5a

Data collection for appropriate responding for subject 2

Student: student2
Date: _____
Time: _____

Appropriate responding

-respond to request within 5 seconds
-carry on with the task at hand
-pronounce word
-sitting upright (ready position) while waiting for instruction
-without gazing in the same direction for 5 seconds
-requesting something by making a gesture

Minutes	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Seconds 10	..	..	..	..	..	..	..	..															..	..	..	..	..	..	..
	.	.	.	.	.	.	.	.															.	.	.	.	.	.	.
20	..	..	..	..	..	..	..	..															..	..	..	..	..	..	..
	.	.	.	.	.	.	.	.															.	.	.	.	.	.	.
30	..	..	..	..	..	..	..	..															..	..	..	..	..	..	..
	.	.	.	.	.	.	.	.															.	.	.	.	.	.	.
40	..	..	..	..	..	..	..	..															..	..	..	..	..	..	..
	.	.	.	.	.	.	.	.															.	.	.	.	.	.	.
50	..	..	..	..	..	..	..	..															..	..	..	..	..	..	..
	.	.	.	.	.	.	.	.															.	.	.	.	.	.	.
60	..	..	..	..	..	..	..	..															..	..	..	..	..	..	..
	.	.	.	.	.	.	.	.															.	.	.	.	.	.	.
Total																													

1st 7 min ___/42 ___%
2nd 6 min___/48 ___%

Total: ___/90
___%

Table 1

Percent interobserver reliability for multiple behaviors for subject 1 and subject 2

Subject 1

Session	Beh. Total	Beh. H	Beh. E	Beh. V	Beh. O	App. R
1	94.4	---	---	---	---	97.7
2	100.0	---	---	---	---	---
3	---	---	---	---	---	94.4
4	100.0	87.8	97.8	80.0	84.4	91.1
9	97.8	100.0	96.7	98.9	96.7	93.3
19	88.9	100.0	93.3	97.7	90.0	---
23	100.0	87.5	96.5	92.0	95.4	93.3
24	---	---	---	---	---	95.5
Mean	96.9	93.9	96.0	92.2	91.6	94.2

Subject 2

Session	Beh. total	Beh. A	Beh.B	Beh. C	Beh. D	App. R
1	100.0	---	---	---	---	100.0
3	97.8	---	---	---	---	---
4	---	---	---	---	---	96.7
5	84.4	94.4	88.9	93.3	95.5	---
9	---	---	---	---	---	83.3
10	93.3	94.4	90.0	95.6	98.9	---
14	92.2	90.0	100.0	97.8	98.8	96.7
23	---	---	---	---	---	93.3
Mean	93.5	92.9	93.0	95.6	97.7	94.0

* see next page for behavior codes

CHAPTER VI

RESULTS

In this section the results of the study are presented. The results for subject 1 are presented before the results for subject 2. For both subjects the data related to the intensity of the exercise sessions are also provided. The basic data for each session and each child are presented in appendix 2. During the study the average heart rate for both subjects was lower for dancing (138.6) than for jogging (146.3). The heart rate was also lower in the morning (mean=138.4) than the afternoon (mean=148.1).

Subject 1

Heart rate (measure of the independent variables)

During the exercise session, the heart rate for subject 1 was generally lower for dancing than jogging. Figures 6 and 7 presents the average heart rate in beats per minute for both treatments for each session. The mean difference obtained was 7.7 beats per minute. The average ranges in heart rate were respectively 128.5 to 162.4 for jogging and 118.9 to 153.2 for dancing. The standard deviations were 11.0 for jogging and 12.6 for dancing. Table 2 presents the average heart rate in beats per minute and the range for each session for subject 1. For subject 1, there was a large difference in heart rate when comparing the average for the morning and the afternoon. On average, the heart rate was lower in the morning and there was a difference of 17.0 beats per minutes between the two time periods. There was also more variation in the morning. The standard deviation obtained for the morning was 10.4 as compared to 6.1 for the afternoon.

Figures 6 and 7

Comparison of heart rate in beats per minutes per session for subject 1 (Bottom figure (7)=morning sessions only)

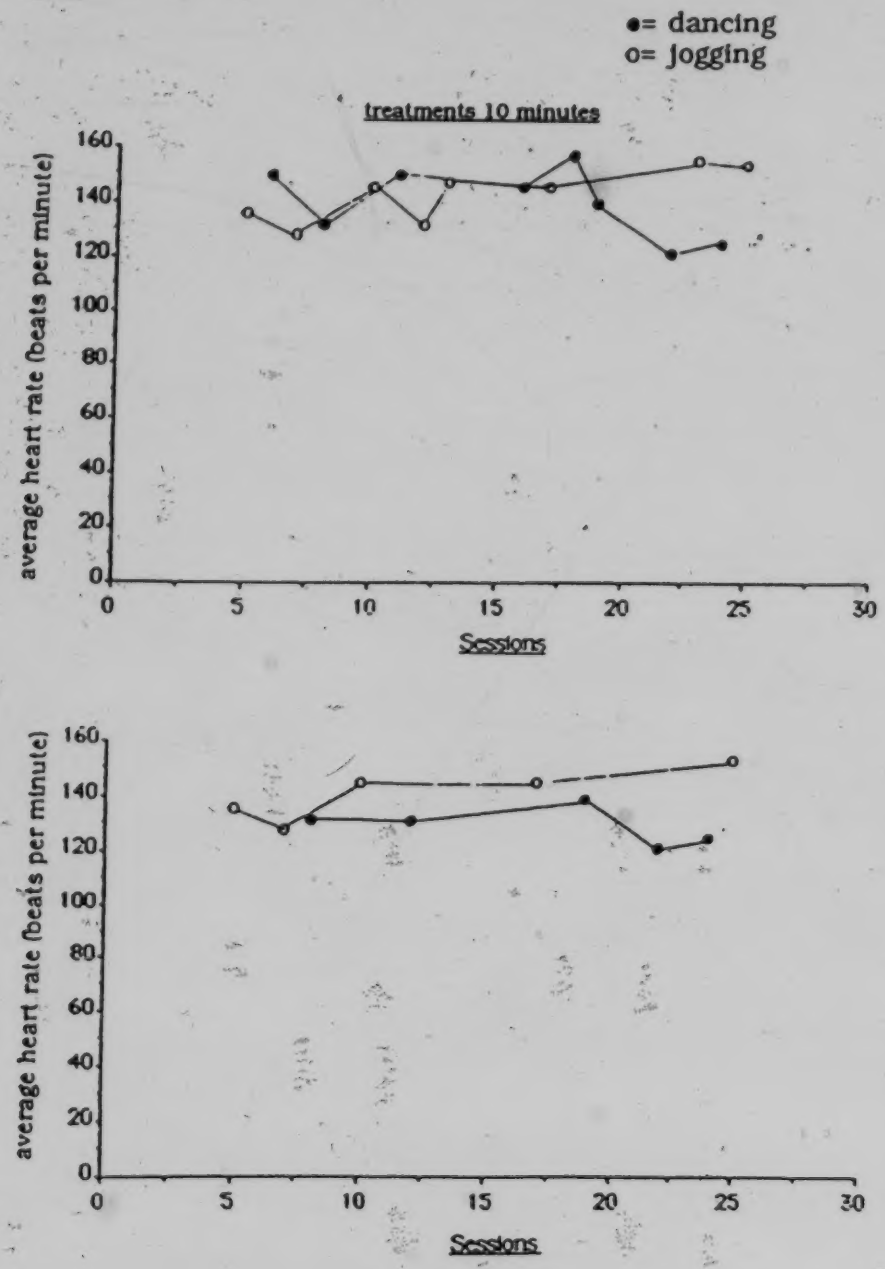


Table 2

Average heart rate and its range for each session of jogging and dancing for subject 1

Session	Treatment	Average heart rate	Minimum heart rate	Maximum heart rate
5	jogging	135.8	128	144
6	dancing	149.6	139	154
7	jogging	127.6	104	146
8	dancing	131.0	112	148
10	jogging	144.9	130	158
11	dancing	149.8	136	159
12	dancing	130.9	123	139
13	jogging	146.5	134	172
16	dancing	145.4	132	155
17	jogging	145.3	130	159
18	dancing	156.4	87	189
19	dancing	139.0	118	161
20	jogging	162.8	140	176
22	dancing	120.3	110	137
23	jogging	154.5	134	172
24	dancing	124.3	113	137
25	jogging	152.6	128	172
27	dancing	-----	---	---

Inappropriate behavior (overall)

The category "inappropriate behavior" (beh. tot.-see table 3) included inappropriate behaviors (mainly stereotyped behaviors) which were grouped together in order to calculate the percentage occurrence during the period of recording (30 minutes). "Beh. tot." included 1) "beh H." or repetitive hand shaking or flipping, 2) "beh. E" or entering finger in eye socket, and 3) "beh. V" or vocal noise or other vocalization other than yelling excluding talking on request. The category "inappropriate behavior" also included: a) "beh. Y" or screaming or loud yelling, b) "beh. B" biting own arm or forearm, and c) "beh. O" which is a cluster of behaviors including head shaking or rolling, stomping feet or swinging legs, body rocking back and forth (Beh. A), making a loud breathing noise (Beh. Br.), placing an inedible object in mouth (Beh. C), flipping, rolling, twirling an object other than a ball from one hand to the next.

Low occurrence behaviors such as "beh. G" or scratching other people's hands, pulling hair, grabbing body parts or clothes, "beh H.S." or hitting own head with hand or object and hitting or slapping body parts or clothes, and "beh. H.B" or head banging against object were not included for the calculation of the percentage of occurrence (interval recording) of "inappropriate behavior (overall)" because in many sessions they did not occur and when they did occur, some of these could continue for several intervals and thus perhaps jeopardize the results. In other words interval recording was not a good measure for these behaviors but it was nonetheless used for the purpose of making a comparison with the other target behaviors selected.

Table 3

CODES AND DEFINITIONS

Subject 1

Codes	definitions
Beh. Tot.	cluster of every inappropriate behaviors for 30 minutes of data collection
Beh. H:	repetitive hand shaking or flipping
Beh. E.	entering finger in eye socket
Beh. V.	vocal noise or other vocalization other than yelling (does not include talking on request)
Beh. O.	head shaking or rolling, stomping feet or swinging legs, body rocking back and forth (Beh A), loud breathing noise (Beh.. Br.), placing inedible in mouth (Beh C), flipping, rolling, twirling object other than a ball from one hand to the next.
Beh. H.B.	head banging against object
Beh. H.S.	hitting head with hand or object, hitting or slapping body parts other than the head,
Beh. B.	biting own arm or forearm.
Beh. G.	scratching hands, pulling hair, grabbing body parts or clothes.
Beh. Y.	screaming or loud yelling
Beh. A, Beh Br., Beh. C./O	see Beh. O.
App. Resp.	appropriate responding as defined
Beh. 1st	first 15 minutes of recording for inappropriate behavior (out of 30 minutes)
Beh. 2nd	second 15 minutes of recording for inappropriate behavior (out of 30 minutes)

The average percentage of "inappropriate behavior" for a 30 minute interval recording was lower following dancing (Mean=68%) than for jogging (Mean=82%) but the average of jogging was close to baseline (Mean=83%). A paired t-test was calculated for this difference and the two-tail probability obtained was significant (p= .04). Table 4 displays the average for each behavior and each treatment for subject 1. Numbers preceded by the symbol @ in table 4 represent the average result obtained by excluding sessions 6, 14, 23, and 25 from the calculation. These sessions were excluded for the calculation in order to obtain a more accurate picture of the treatment effects. They were excluded because of extreme fatigue, sickness and or because of a major change in activity or room. When a difference of a minimum of plus or minus 3 was obtained as compared to the mean obtained without excluding sessions, a sign (>) was placed beside the number.

Figures 8 and 9 present the rate of inappropriate behavior for each treatment and session (separate figures for results in the morning for each behavior were drawn because a routine activity was performed at this time producing less variability in data.) The data path for dancing is generally below the data path for jogging which suggests that the treatments' effects are generally different. Also it can be seen from table 4 that there was little or no difference found between the measurement of the first and last 15 minutes of recording for the overall behavior.

An additional calculation was computed for "inappropriate behavior (overall)" and for the other dependent variables. The Pearson product-moment coefficient of correlation was calculated to (1)

Table 4

Total average in percentage of interval occurrences for each treatment and each measured behavior for subject 1

Behavior	Baseline	Control	Jogging	Dancing	Morning	afternoon
Beh. Tot.	83.42	74.13 @76.93	82.26 @83.22	68.09 @67.02	68.58 @72.49>	81.55 @81.55
Beh. 1st	84.46	75.58 @79.80>	79.76 @79.68	67.57 @66.81	70.34 @74.72>	75.80 @76.91
Beh. 2nd	83.6	72.30 @73.43	80.39 @81.64	68.64 @67.21	66.83 @70.46>	82.97 @83.13
Beh. H	22.22	5.55 @7.40	10.37 @10.34	0.94 @0.38	.078 @3.72	10.60 @17.04>
Beh. E	35.58	17.18 @20.87>	27.00 @29.92	14.46 @14.39	16.83 @18.87	23.61 @31.93>
Beh. V	18.12	12.83 @16.37>	21.16 @17.02>	9.42 @8.86	10.58 @11.89	19.50 @17.25
Beh. O	56.72	52.88 @51.97	58.37 @56.36	51.17 @49.02	49.92 @50.63	60.16 @56.71>
Beh. A/O	49.78	37.23 @38.53	30.50 @27.10>	22.20 @24.18	30.91 @35.31>	18.06 @27.90>
Beh. Br/O	30.00	29.78 @34.47>	42.34 @43.08	35.81 @33.49	34.86 @35.15	43.70 @34.76>
% Br only	11.3	22.88 @26.23>	46.21 @49.24>	43.67 @38.28>	35.27 @29.78>	58.21 @38.63>
Beh. C/O	0.00 0.00	1.40 @0.00	0.79 @1.10	0.11 @0.12	0.66 @0.47	0.00 @0.00

@: calculation of the mean with the exclusion of sessions 6, 14, 23 and 25

>: difference of a minimum of plus or minus 3 between the two computations

Table 4 (continued)

Total average in percentage of interval occurrences for each treatment and each measured behavior for subject 1

Behavior	Baseline	Control	Jogging	Dancing	morning	afternoon
Beh. B	1.16	1.13	0.27	0.40	0.41	0.25
		@0.93	@.13	@0.44	@0.68	@0.46
Beh. Y	1.20	0.45	0.51	0.41	.023	0.77
		@0.60	@0.13	@0.25	@0.40	@0.63
Beh. H.B.	0.90	0.55	0.31	0.35	.007	.071
		@0.73	@0.44	@0.38	@0.33	@0.98
Beh. H.S.	3.32	0.55	0.09	0.23	0.06	0.33
		@0.37	@.12	@0.26	@0.24	@2.16
Beh. G.	0.00	1.25	2.96	3.45	0.62	7.00
		@0.73	@1.56	@0.69	@0.52	@1.11
App.Resp	23.82	26.73	32.13	34.92	30.20	38.87
Total		@26.93	@34.52	@38.01>	@27.52	@41.16
App.	21.24	30.25	35.52	38.06	38.93	34.30
Resp 1st		@31.33	@36.64	@40.02	@33.63	@34.10
App.	22.44	29.12	33.93	36.76	34.78	36.76
Resp 2nd		@29.97	@35.48	@39.09	@30.86	@37.40

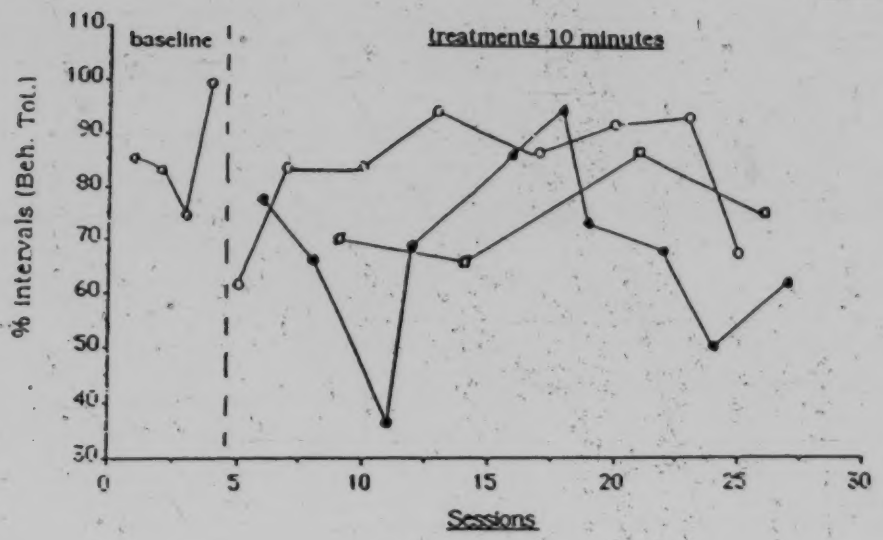
@: calculation of the mean with the exclusion of sessions 6,14, 23,and 25

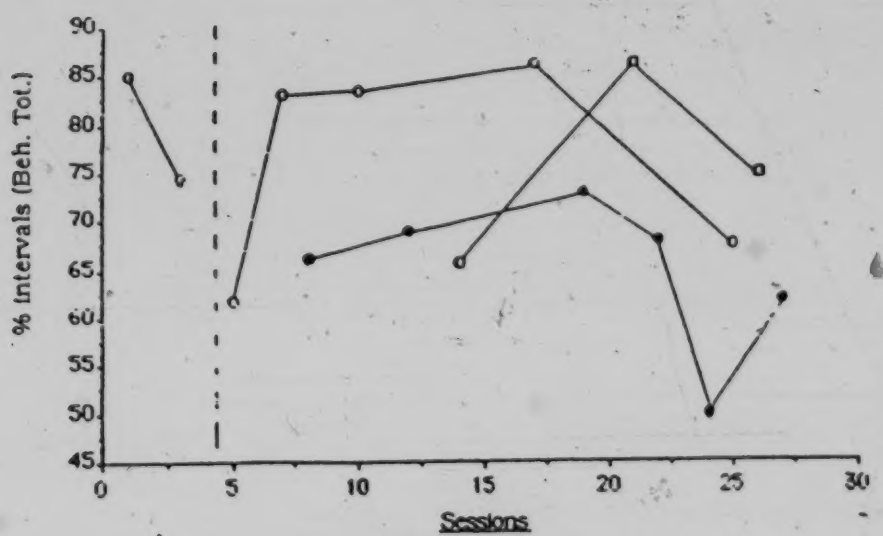
>: difference of a minimum of plus or minus 3 between the two computations

Figures 8 and 9

Comparison of inappropriate behavior (Beh. Tot.) in percentage of interval occurrences per session for subject 1 (bottom figure (9)=morning sessions only)

●=dancing □=control
o=jogging





identify patterns of association between variables for each treatment. (2) to find out the strength of the association between heart rate during the treatment, and the treatment effects, and (3) to examine the independence of the appropriate responses from inappropriate behavior. The correlation coefficient obtained for "inappropriate behavior" and "heart rate" was similar for dancing and jogging (.34 and .36 respectively). "Appropriate responding" such as taking an upright posture while not rocking or shaking for five seconds (the child was usually not sitting upright and was often rocking on a chair), or attempting to sign or make a gesture, and many more, and "inappropriate behavior" were almost totally independent for the dancing condition (r= .15) but the correlation coefficient was slightly higher for jogging (-.34).

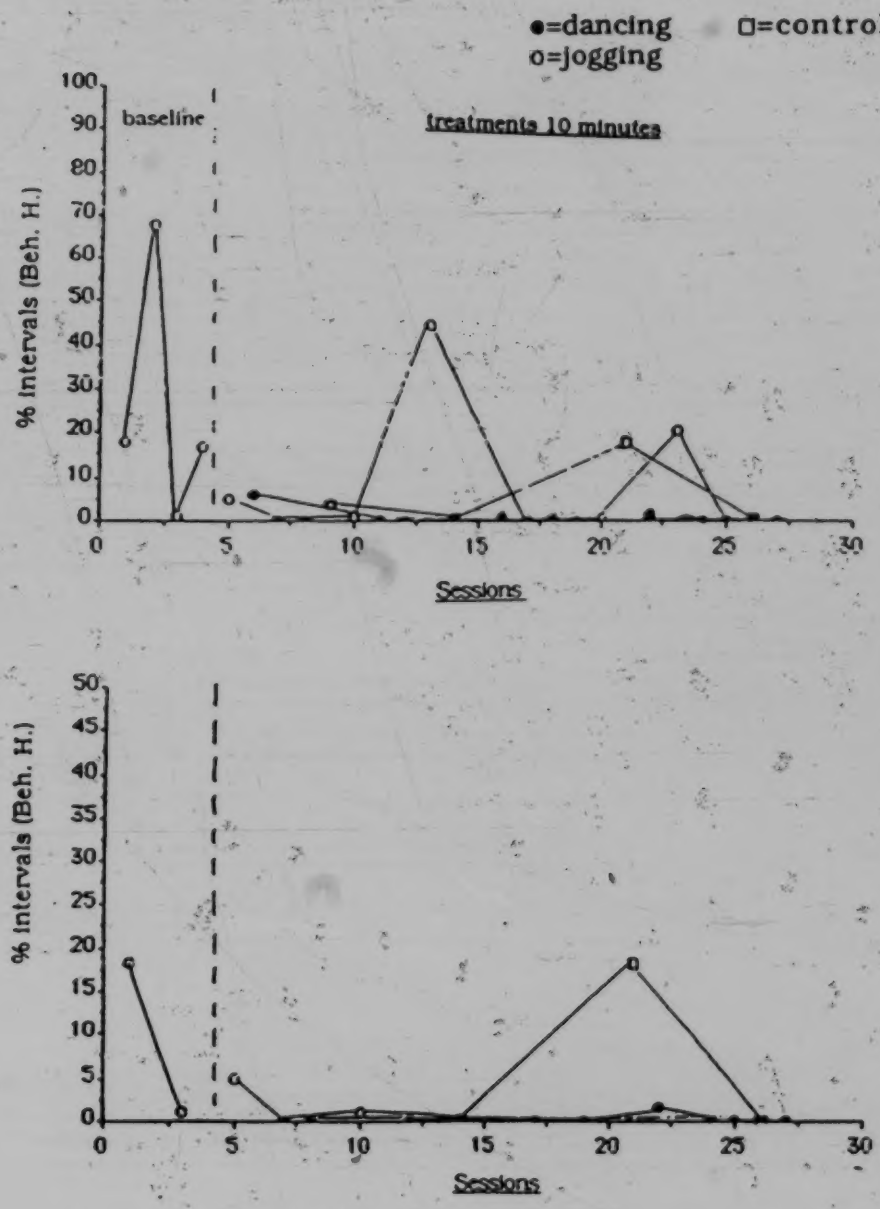
Hand shaking

"Beh. H." or repetitive hand shaking or flipping was reduced by all the 3 treatment conditions compared to baseline performance (see table 4). The average for dancing for 30 minutes of interval recording was lower than the average for jogging. Figure 10 displays the results for each treatment condition for each session. The data path for dancing is consistently near 0. However, it is interesting to note that hand shaking was higher on the afternoon than the morning. Figure 11 presents the same data for the morning only. Both jogging and dancing consistently maintained this behavior near 0 but it reached 0 once during baseline.

The correlation coefficient obtained for "hand shaking" and heart rate was low for dancing and jogging (.27 and .11 respectively). The correlation for "beh. H" with appropriate responding was negative

Figures 10 and 11

Comparison of hand shaking (Beh. H) in percentage of interval occurrences per session for subject 1 (bottom figure (11)=morning sessions only)



and it was similar for jogging and dancing (-.49 and -.44). The highest correlation for hand shaking was obtained with "beh. E" or entering finger in eye socket for jogging (.66) compared to only .06 for dancing. This suggests that for jogging "beh. H" and "beh. E" tended to vary together but not for dancing. Hand shaking also correlated moderately (between .40 to .60) with "beh. V", "beh. O," and "beh. Br" or loud breathing noise for both treatments.

The direction of the correlation coefficients obtained was reversed when comparing both treatments for "beh. A" (body rocking, head shaking or rolling, and stomping feet or swinging legs) (.48 for jogging and -.57 for dancing) and for "beh. Br." (-.62 for jogging and .54 for dancing) suggesting that the pattern of changes in behavior obtained from both treatment forms may have been different.

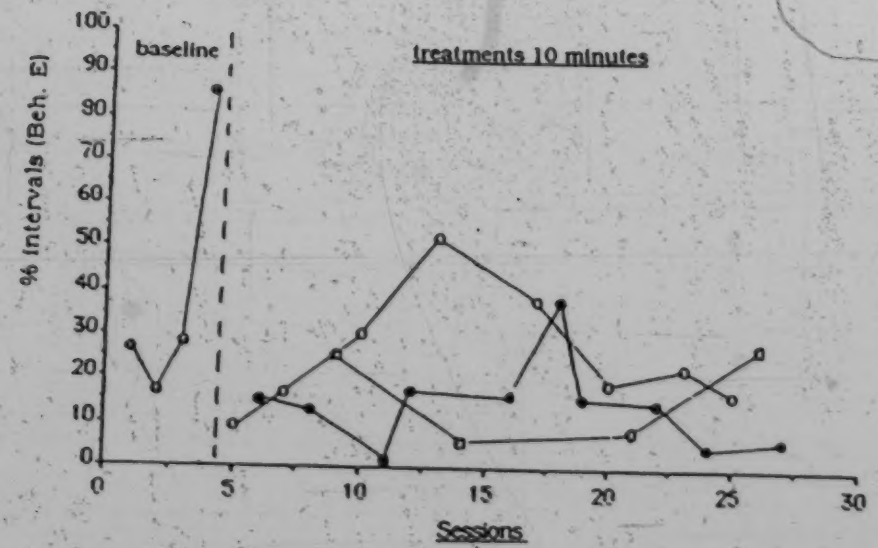
Eye socket poking

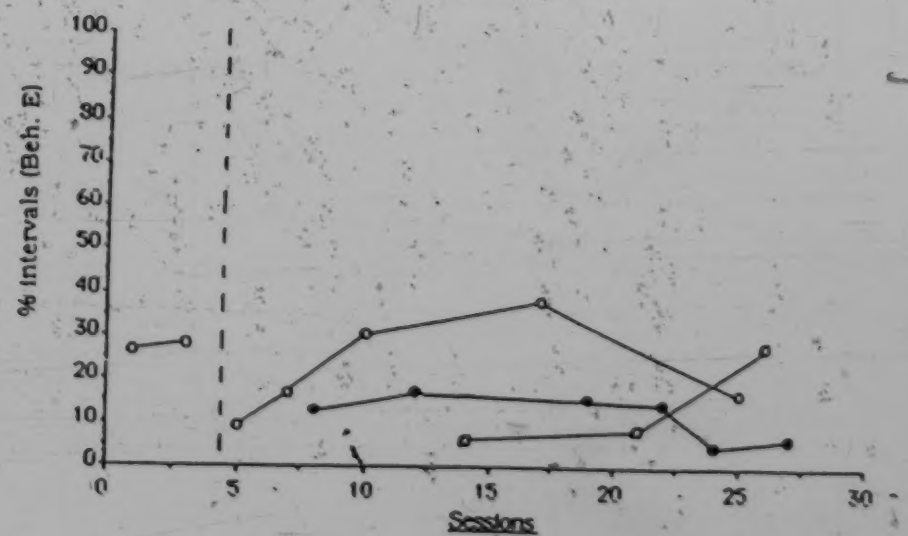
Entering a finger in the eye socket or "beh. E." was reduced compared to baseline for all three treatment conditions. The average for dancing was the lowest followed by the average for control (when excluding session 6, 14, 23, and 25 from the calculation, see table 4, the average percentage for the control condition increased but the relative treatment effectiveness remained unchanged. The average for jogging remained relatively high). Figure 12 displays the data for each session and treatment. The data path for dancing is below this one for jogging. Figure 13 presents the same data for the morning sessions only. The data path for dancing is clearly below this one for jogging. Also, on average entering a finger in the eye socket was higher in the afternoon than in the morning.

Figures 12 and 13

Comparison of eye socket (beh. E) in percentage of interval occurrences per session for subject 1 (bottom figure (13)=morning sessions only)

●=dancing □=control
o=jogging





The correlation coefficient obtained for "beh. E." and heart rate was .40 for dancing and only .12 for jogging. This suggests that the intensity of the dancing session may have been related to its effect on entering a finger in the eye socket while the same relationship is very low for jogging. The correlation of "beh. E" with appropriate responding was negative. It was -.46 for jogging and -.28 for dancing.

The highest correlation coefficient obtained for entering a finger in the eye socket was with breathing noise for dancing (.80) as compared to (-.40) for jogging. The lowest association was with hand shaking for dancing (.08). This correlation between hand shaking and eye socket poking was .66 for jogging. The direction of the correlation was reversed for "beh. A" and "beh. Br". A correlation of -.49 was obtained with behavior A for dancing as compared to .27 for jogging. And as pointed out, a high correlation of .80 of "beh. E" with breathing noise was obtained for dancing compare to a negative correlation of -.40 for the same variables for jogging. Thus several correlation coefficients were reversed when comparing the covariation obtained for jogging and the covariation obtained for dancing suggesting that the effects of both treatment may have produced different pattern of behavior changes related to "beh. E".

Vocalization

The average over 30 minutes of interval recording for "beh. V" or vocalizations other than talking on request and other than yelling, was lower for dancing as compared to both jogging and control. The average for jogging was increased compared to baseline. However, by excluding session 6, 14, 23, and 25 the average for jogging and for

control are both similar to the average for the baseline condition. "Beh. V." was also higher in the afternoon than in the morning.

The correlation of vocalization with heart rate was similar for both treatments (.43 for jogging and .39 for dancing). A negative correlation of -.69 was obtained for "beh. V" with appropriate responding for jogging as compared to a low .10 for dancing. This suggests that for jogging, when vocalization was low, appropriate responding was high and vice versa. However, this was not true for dancing.

The highest correlations obtained for "beh. V" was .85 with "beh. O" for jogging and .73 for eye socket poking for dancing. The lowest one was .03 with breathing noise for jogging. This correlation with breathing noise was .64 for dancing. The correlation of "beh. V." with "beh. O" was also reversed for dancing and jogging (-.46 and .26). However, similar correlations were obtained for vocalization and "beh. H." for both treatments (.57 for jogging and .57 for dancing). Thus, some behaviors were covarying similarly with vocalization for both treatment forms but most of the behaviors were differently correlated following dancing and jogging.

Other behaviors

The category "other behaviors" or "beh. O" included a cluster of behaviors. Body rocking, head rolling, legs swinging (beh. A), loud breathing noise or ventilation (beh. Br), placing objects in the mouth (beh. C), and flipping, rolling, twirling an object other than a ball from one hand to the next were included under this category. The average result for 30 minutes of interval recording for "beh. O" was lower for dancing but only slightly lower than control. Both were almost equal

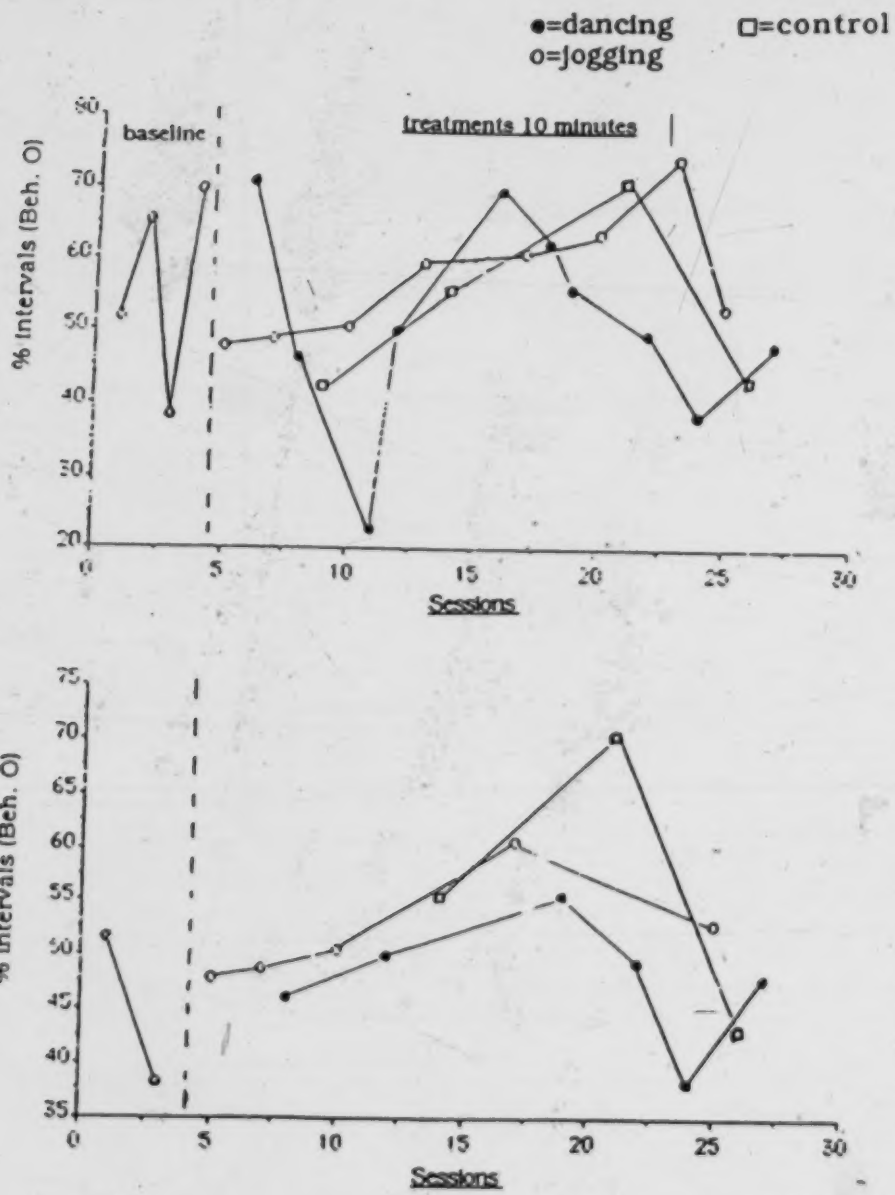
to the average for baseline. The average for jogging was higher than for baseline. A paired t-test for jogging and dancing showed no significant differences (p=.36) obtained between these two treatments. Figure 14 shows the inconsistency of the data paths although it appears that the data path for dancing is below the two other paths. Figure 15 displays the data for each session for the morning. The data paths for dancing and jogging do not overlap but they are in the range of the data for baseline. "Beh. O" was higher in the afternoon than in the morning.

The correlation coefficients obtained for "beh. O" with heart rate was a high .70 for jogging and .31 for dancing. This association of .70 with heart rate was the highest obtained for jogging with heart rate among all categories of inappropriate behaviors. It is important to note that these correlations are positive suggesting that, especially for jogging, as the heart rate obtained tended to be high, "beh. O" also tended to be high and vice versa. The obtained correlation for "beh. O" and appropriate responding were respectively -.38 for jogging and -.10 for dancing. The highest correlation coefficient obtained for "beh O" was a high .91 with breathing noise for dancing as compared to .30 for jogging. This suggests that "beh. Br" might have been a strong contributor to the category "beh. O" especially for dancing.

"Beh. O" was subdivided into 3 behaviors: "beh. A", "beh. Br" and "beh. C". The interval recording for this subdivision was performed during the beginning 15 minutes of the 30 minutes observation period. For "beh. A" the average result was lower for dancing. A paired t-test comparing the result for jogging and dancing was not statistically significant (p= .22). This behavior was reduced by the 3

Figures 14 and 15

Comparison of other behavior (Beh. O) in percentage of interval occurrences per session for subject 1 (bottom figure (15)=morning sessions only)



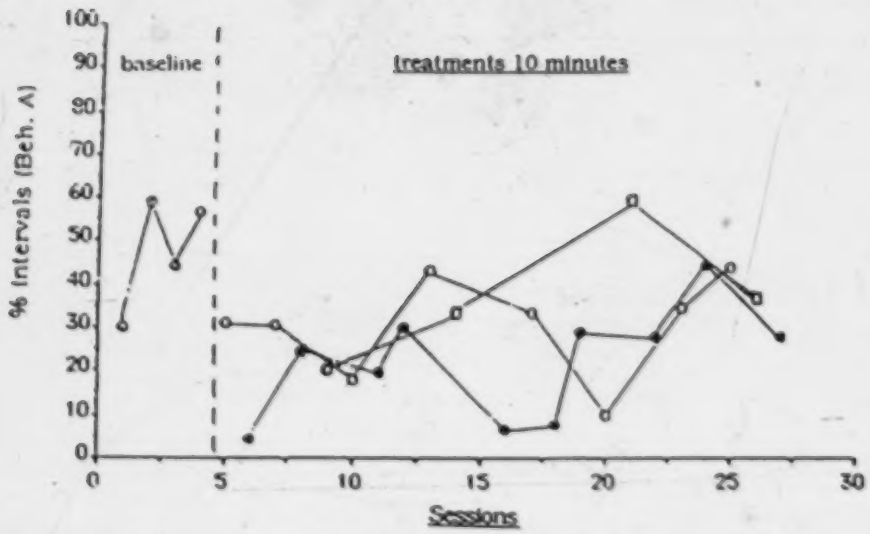
treatment conditions. On average "beh. A" or body rocking was much lower in the afternoon. By excluding session 6, 14, 23, and 25 from the calculation, the difference between the two time periods was not reduced even though the average result for both is increased when compared to no row exclusion. Figure 16 presents the results for each session and treatments. The data path for dancing is generally below the two other paths. Figure 17 displays the same results for the sessions taking place in the morning only. The effect of jogging and dancing on "beh. A" appeared to be similar.

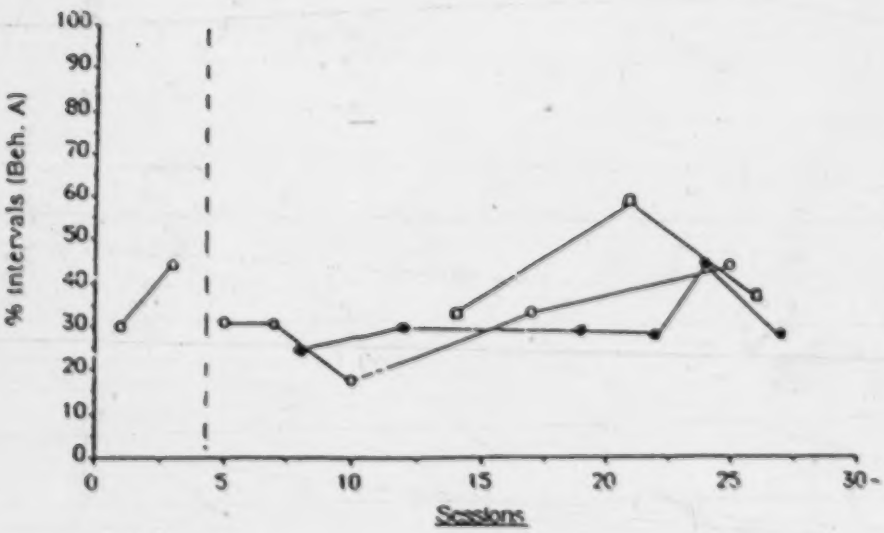
The correlation of head shaking, leg swinging and body rocking (beh. A) with heart rate was -.24 for jogging as compared to a high -.81 for dancing. The obtained correlation coefficient of -.81 for "beh. A" is the highest association obtained with heart rate among the other inappropriate behavior for dancing. This suggests that the more intense (the higher the heart rate) the dancing session, the more body rocking had a tendency to be reduced following this treatment condition. The correlation with appropriate responding was -.63 for jogging and -.19 for dancing. For dancing the correlation coefficient obtained for "beh. A" and the other inappropriate behaviors were all negative suggesting that as "beh. A" decreased, the other inappropriate behavior had a tendency to increase and vice versa. For jogging, they were positive for "beh. H", "beh E", and "beh. V." but they were negative for "beh. O" and "Beh. Br". The correlation coefficients obtained for body rocking with "beh. Br" were high and negative and similar for both treatments (-.63 for jogging and -.73 for dancing). Thus, it appeared that the patterns and strength of association

Figures 16 and 17

Comparison of body rocking, head and legs swinging (Beh. A) in percentage of interval occurrences per session for subject 1 (bottom figure (17)=morning sessions only)

●=dancing □=control
o=jogging





between the dependent variables and "beh. A." were generally different for jogging and dancing.

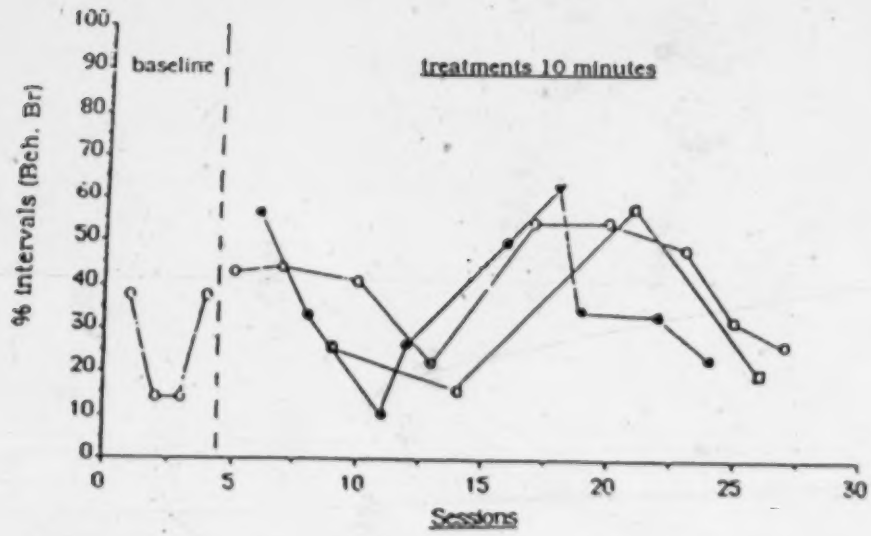
For "beh. Br" or breathing noise, the average result was lower for baseline and control (this may suggest that "beh. Br. might have been produced by the main treatment conditions. Perhaps it is related to exertion following the exercise session). The average result for both jogging and dancing is higher than the average for the baseline. However the average for dancing is lower than the average for jogging (p= .11). Figures 18 and 19 present the data for each session. The data for the morning clearly indicates the difference between jogging and dancing. Behavior Br appeared to be occurring equally on the afternoon and the morning once session 6, 14, 23, and 25 were excluded from the calculation. However, without this exclusion, "beh. Br" was higher in the afternoon.

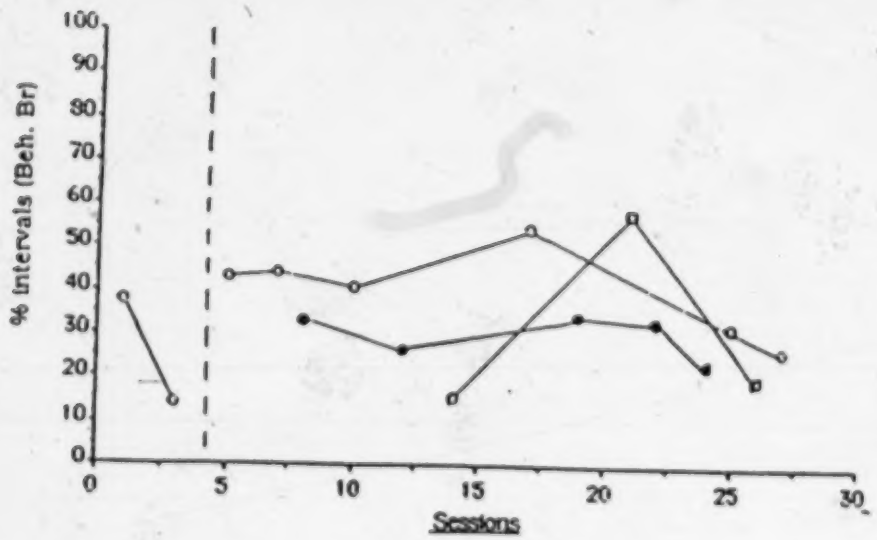
Breathing noise was often occurring alone within one interval without the presence of "beh. A" or "beh. C". Thus the proportion of "beh. Br" alone, or without the presence of "beh. A" and "beh. C" (other behaviors included in "beh. O") within a 10 seconds interval was computed. The average proportion of "beh. Br." alone for the control condition was similar to the baseline condition. However, the proportion of "beh. Br" alone was increased as compared to baseline for dancing and jogging . Figure 20 displays the proportion of breathing noise alone. Although there is consistent overlap between the data paths for jogging and dancing, the figure clearly shows that the proportion of Br alone is increased compared to baseline by both jogging and dancing (p= .76). The data path for control is below the two other paths. Also, by excluding the rows 6, 14, 23 and 25, a

Figures 18 and 19

Comparison of breathing noise (Beh. Br) in percentage of interval occurrences per session for subject 1 (bottom figure (19)=morning sessions only)

●=dancing □=control
o=jogging

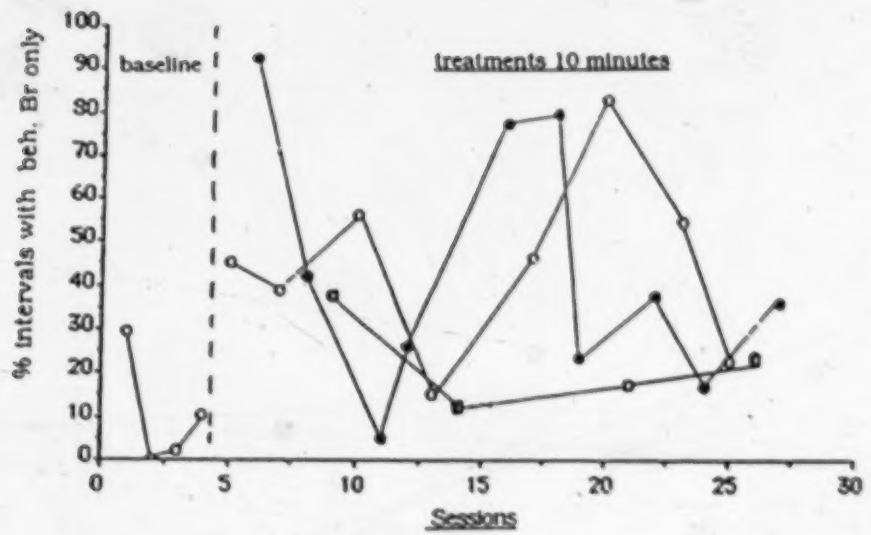




Figures 20

Comparison of interval with breathing noise only (Beh. Br) in percentage of interval occurrences per session for subject 1

●=dancing □=control
o=jogging



difference of 11% for the proportion of "beh. Br" between jogging and dancing is obtained; dancing being lower than jogging (Thus, it is possible that "beh Br" alone might have accounted in large part for the difference obtained between jogging and dancing for "beh. O" but perhaps also for "beh. tot"). The proportion "beh. Br" alone was also much higher in the afternoon than in the morning.

The correlation coefficient obtained for breathing noise with heart rate was .15 for jogging and .50 for dancing. Thus, this suggests that when the heart rate was high for dancing, "beh. Br' also tended to be high. The correlation of "beh. Br" with appropriate responding was low for both treatments (.10 for jogging and .08 for dancing).

"Beh. C" was found to be a low occurrence behavior. The average result was the lowest for dancing as compared to control or jogging but this behavior was not present during the baseline phase.

Remaining behaviors

Beh. Y or loud yelling, "beh. B" or biting own forearm or hand, and "beh. H.B or head banging, "beh. H.S." or hitting self "beh. G" or grabbing other were low occurrence behaviors. These behaviors were occurring in less than 4 % of intervals. With the exception of grabbing (beh. G), the average for each of these behaviors was lower during the treatment phases than during baseline. The average results for jogging and dancing were lower than for control. The results obtained for the afternoon were generally higher than for the morning with the exception of "beh. B".

Appropriate responding

The average result for 15 minutes of interval recording for appropriate responding (App. Resp. Total) was higher for each

treatment condition than for baseline. The average for dancing was slightly higher than for jogging and the average for jogging was higher than for control. The results of a paired t-test for dancing and jogging revealed no significant difference (p= .80). For the first 7 minutes and the last 8 minutes of the 15 minutes of recording, the results were similar to the total interval. Figure 21 and 22 display the data for each session. Although there is overlap between the data paths, the data points for each session for dancing or jogging are generally on the upper limit of the range for baseline or over it.

The correlation of appropriate responding with heart rate was .29 for jogging and .04 for dancing. The correlations for appropriate responding and other behaviors were presented previously.

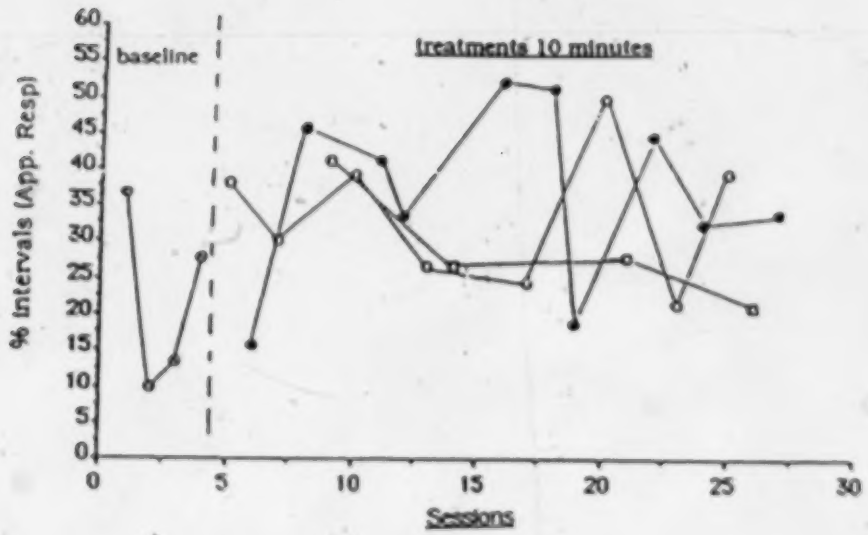
Summary

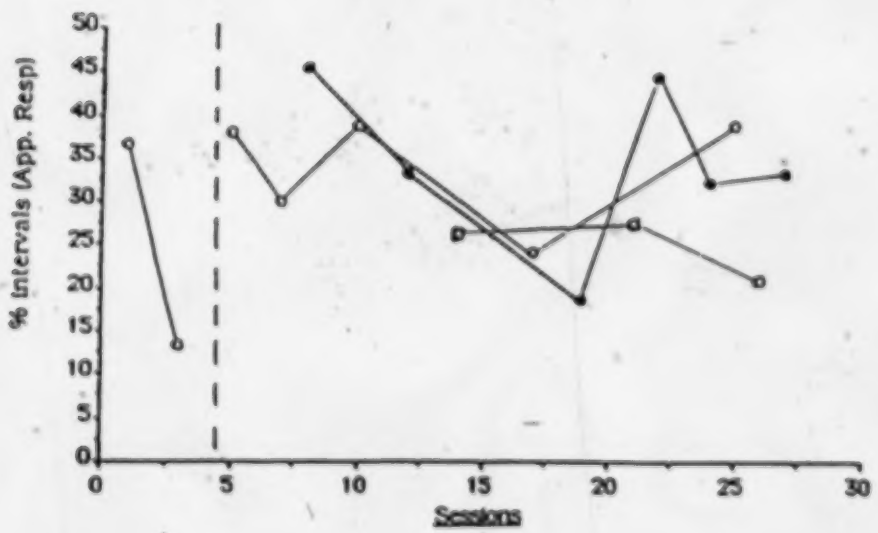
Thus, to summarize, the average results for subject 1 typically showed less inappropriate behavior (desired effect) for dancing than jogging. The average was slightly lower for jogging than dancing, however, for head banging (beh. H.B.) and biting own forearm (beh. B). Also the average for control was lower than for jogging for several behaviors including the total of inappropriate behavior (beh. tot), hand shaking (beh. H), entering a finger in one eye socket (beh. E), vocalization (beh. V) and other behaviors (beh. O.-cluster of behaviors.). The average for jogging was higher than baseline (undesired effect) for breathing noise (beh. Br) and vocalization (beh. V) and was almost equal to baseline for other behaviors (beh. O.). The proportion of breathing noises alone (or when beh. Br. was the only response present in an interval of measure) was also the highest for jogging. On average, the percent of intervals for appropriate responding was not

Figures 21 and 22

Comparison of appropriate responding (App. Resp) in percentage of interval occurrences per session for subject 1 (bottom figure (22)=morning sessions only)

o=dancing □=control
o=jogging





under the average for baseline as it would have been expected if fatigue would have been playing a major role in the behavioral change obtained. In fact, the percent appropriate responding was highest for exercise than for control. The average result for dancing was slightly larger than for jogging.

Subject 2

Heart rate

During the exercise sessions, the heart rate for subject 2 was lower for dancing than for jogging. The mean difference was 7.6 beats per minute. The standard deviations were 6.1 for jogging and 5.2 for dancing. The mean for the minimum and maximum scores for each session for heart rate were 132.1 and 155.4 for jogging and were 126.8 and 150.5 for dancing. For subject 2 there was a very small difference in heart rate between the morning and the afternoon (2.7 beats per minutes less in the morning). Figure 23 compares the average heart rate for both treatments for each session. Table 5 presents the average heart rate in beats per minute and the range for each session for subject 2.

Inappropriate behavior

The category "inappropriate behavior" (beh. Tot.) included behavior for 30 minutes of interval recording such as "beh. A", or placing finger in and out the mouth, "beh. B." or placing hand in mouth and sucking it while gazing, "beh. C." or body rocking, tapping and twirling, and "beh. D." or vocalization, (see table 6). The average for 30 minutes of interval recording for inappropriate behavior for each treatment was lower for dancing. A paired t-test was computed, and the difference obtained was not statistically significant (p=.11). The

Figure 23

Comparison of heart rate in beats per minutes per session for subject 2

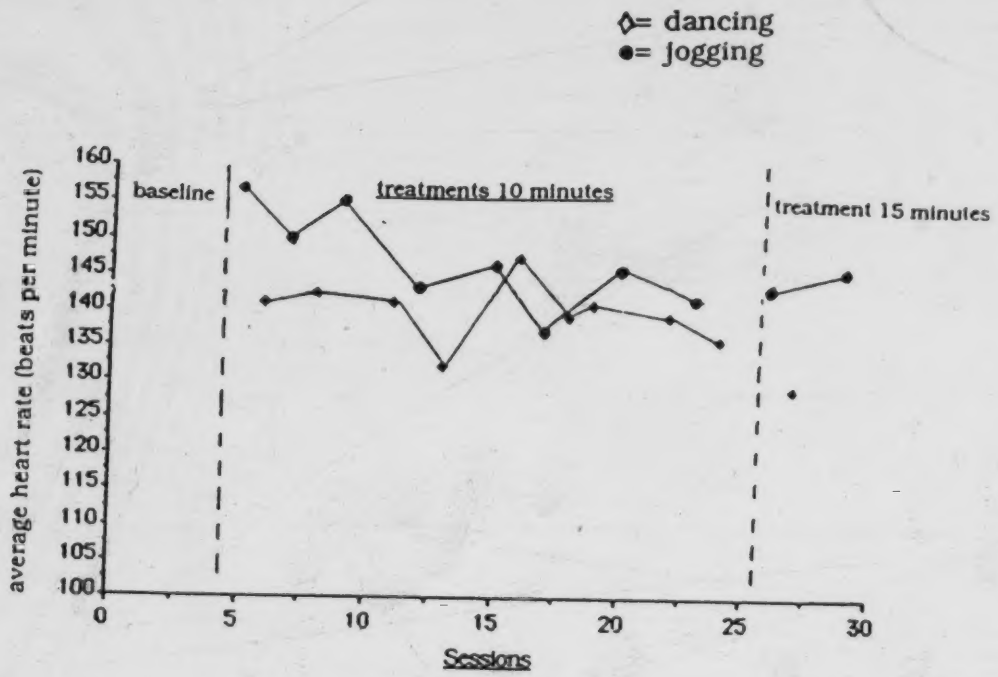


Table 5

Average heart rate and its range for each session of jogging and dancing for subject 2

Session	Treatment	Average heart rate	Minimum heart rate	Maximum heart rate
5	jogging	156.6	143	170
6	dancing	141.0	120	163
7	jogging	150.0	---	---
8	dancing	142.2	138	158
9	jogging	155.0	---	---
11	dancing	141.0	135	155
12	jogging	143.2	130	147
13	dancing	132.2	116	145
15	jogging	146.1	140	155
16	dancing	147.1	132	160
17	jogging	137.0	114	145
18	dancing	138.9	125	153
19	dancing	140.6	118	144
20	jogging	145.6	134	159
22	dancing	139.0	133	143
23	jogging	141.3	125	147
24	dancing	135.8	126	144
26	jogging	143.0	131	164
27	dancing	129.0	125	140
29	jogging	145.1	140	156

Table 6

CODES AND DEFINITIONS

Subject 2

Beh. Tot.	cluster of behaviors A, B, C, D for 30 minutes of recording
Beh. A.	placing finger in and out the mouth,
Beh. B.	placing hand in mouth and sucking it while gazing (distracted).in the same direction for 5 seconds
Beh. C.	body rocking back and forth,swinging, tapping or twirling object and twirling hair with fingers
Beh. D.	making vocal noise or vocalization other than talking
App. Resp.	appropriate responding as defined
App. Resp. 1st	first 7 minutes of interval recording (out of 15 minutes)
App. Resp. 2nd	second 8 minutes of interval recording (out of 15 minutes)

average results for each target behavior and each treatment condition is presented in table 7 (as for subject 1, the average of results was computed in excluding some sessions likely affected by confounding variables such as a major change in activity and setting, sickness, and or boredom). The results with the exclusion of session 16, 18 and 22 are presented below the result including every session. When a difference of at least plus or minus 3 was obtained, a symbol (>) was added to the right of the number. By excluding session 16, 18 and 22 for the overall behavior, the average result for dancing is still lower than the average for jogging, but the difference is reduced. Figure 24 shows the results for each session (no exclusion). Although there is some overlap between the data points for the treatment, the data path for dancing is generally below the data path for jogging. The increase in the duration of exercise from 10 to 15 minutes starting at session 26 did not further reduce the average for inappropriate behavior. The mean result for 15 minutes of jogging was 58.3% and the result for dancing was 55.3%.

When comparing the first 15 minutes of interval recording with the second 15 minutes for inappropriate behavior, the differences obtained were not consistent. The average results for the first 15 minutes interval was smaller than for the second interval for jogging and was larger than the second one for baseline, control and dancing . When comparing the average result for "Beh. 1st.", the average for dancing and jogging were almost equal. However, when comparing the average for "beh. 2nd." for dancing and jogging, the average for dancing was lower than the average for jogging and this with or without excluding rows.

Table 7

Total average in percentage of interval occurrences for each treatment and each measured behavior for subject 2

Behavior	Baseline	Control	Jogging	Dancing	Morning	Afternoon
Beh. total	72.4	64.78	63.90	57.66	61.33	59.76
				@61.00>	@63.48	@66.42>
Beh. 1st	75.88	66.85	63.50	62.06	61.98	63.66
				@65.13>	@63.37	@70.99>
Beh. 2nd	68.60	62.53	64.08	53.37	60.70	55.83
				@57.03	@63.48	@61.75>
Beh. A	54.08	44.28	49.04	45.72	51.09	43.00
				@51.82>	@51.31	@48.09>
Beh. B	17.15	12.03	11.50	9.66	6.56	14.99
				@7.45	@8.77	@14.83
Beh. C	4.48	5.78	3.88	3.00	3.19	3.66
				@3.33	@3.47	@5.04
Beh. D	6.63	6.78	4.96	2.49	3.50	3.80
				@1.97	@4.67	@4.92
App. Resp.Total	51.83	63.03	66.48	55.22	67.60	52.08
				@67.75>	@67.60	@58.65>
App. Resp. 1st	46.70	67.25	58.34	56.59	68.15	52.08
				@74.98>	@68.15	@55.46>
App .Resp. 2nd	54.7	59.35	71.3	52.71	64.17	47.23
				@59.32>	@64.17	@61.25>

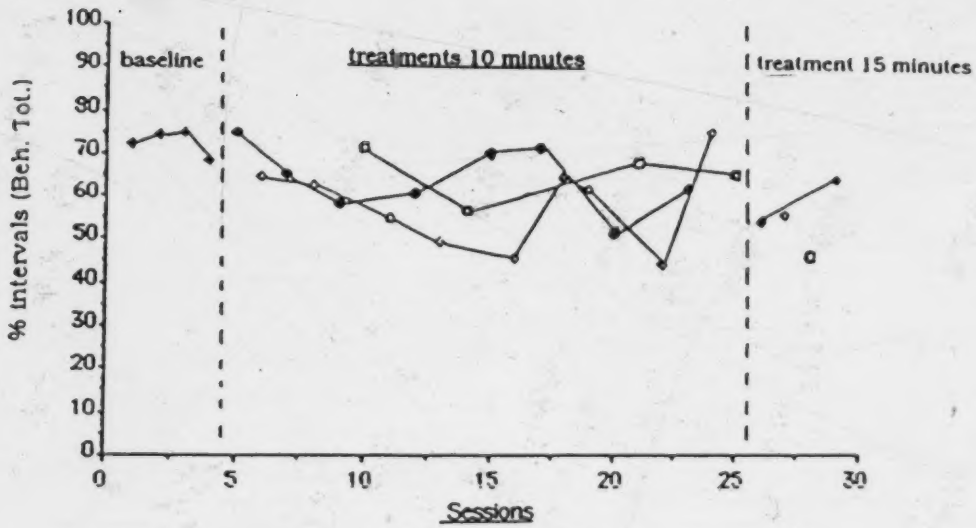
@: calculation of the mean with the exclusion of sessions 16, 18, and 22

>: difference of a minimum of plus or minus 3 between the two computations

Figure 24

Comparison of inappropriate behavior (Beh. Tot) in percentage of interval occurrences per session for subject 2

◊=dancing □=control
●=jogging



The correlation coefficients obtained for heart rate and "beh. tot." was a low .20 for dancing and a very low .08 for jogging suggesting that the intensity of exercise as measured by the heart rate was not an important factor in the result obtained for inappropriate behavior. Also there was a high positive correlation of .64 between appropriate responding and inappropriate behavior for dancing (.47 for jogging) suggesting that the two categories of dependent variables were not totally independent (In fact, they should have been unrelated or inversely related).

Fingers in mouth

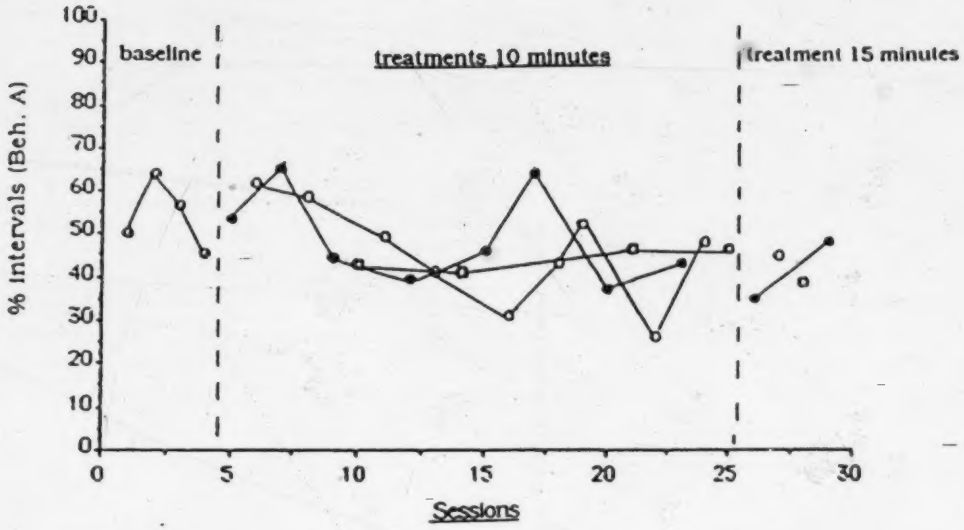
The average for 30 minute intervals for "repetitively entering and removing fingers in mouth" (Beh. A) was lower under the control condition. In excluding session 16, 18, and 22 the average difference between jogging and dancing was reduced although the average for dancing remained smaller than for jogging. Figure 25 shows the results for beh. A for each session. There is consistent overlap between the data paths. Increasing the treatment duration from 10 to 15 minutes from session 26 did not produce a noticeable change. The average result for jogging was 41.7% and the result for the dancing session was 44.7%. Also, the average for placing fingers in and out the mouth was lower during the afternoon than during the morning.

Placing fingers in mouth correlated highly with heart rate for dancing (.83) and minimally for jogging (.06). It is important to note, however, that the correlation is positive suggesting that as the intensity of the dancing session tended to be high, "beh. A" also tended to be high and vice versa. The correlations between "beh. A" and "beh. B" were quite similar for both treatment forms. The

Figure 25

Comparison of fingers in mouth (Beh. A) in percentage of interval occurrences per session for subject 2

o=dancing □=control
●=jogging



correlations were -.41 for dancing and -.34 for jogging. Beh. A correlated .81 with appropriate responding for dancing and .44 for jogging. These high positive correlations also suggests that beh. A was not independent of appropriate responding. The more beh. A tended to be high, the higher the appropriate responding. The patterns of correlation obtained for beh. A were quite similar for both treatment forms in that the correlation obtained were all in the same direction, however, they were also different in term of the strength of the relationship obtained.

Gazing

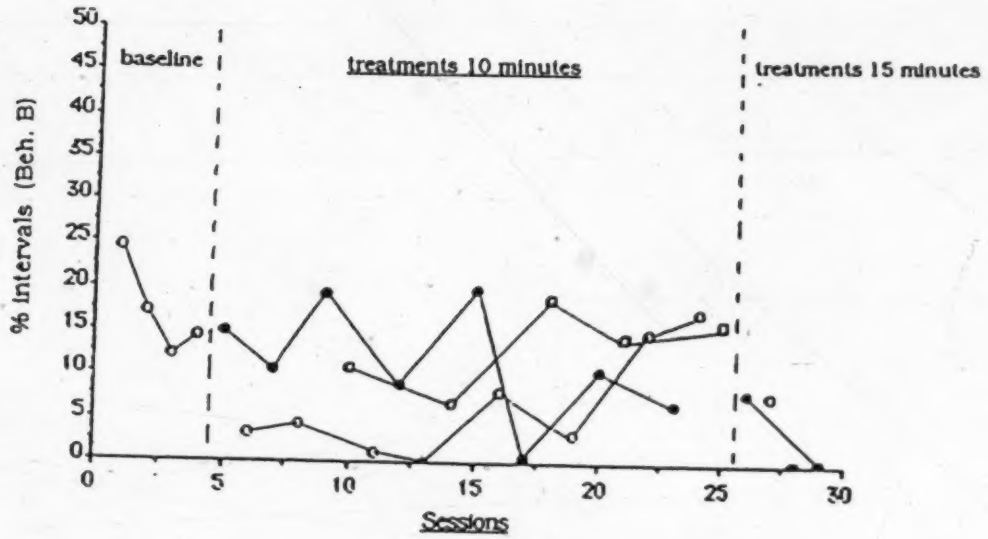
The average for 30 minutes of interval recording for "gazing with hand in mouth" (beh. B) was lower for dancing. The results of a paired t-test for this difference was not significant (p= .59). Figure 26 shows the results for beh. B for each session. The data path for dancing is under the two other paths. Fifteen minutes of treatment instead of ten minutes further reduced beh. B. The average result for jogging was 4.3% and the result for the dancing session was 7.9%.

For jogging a high correlation of .77 was obtained for heart rate and gazing while this correlation was of -.28 for dancing. The direction of the correlation was also reversed for beh. D with gazing. While the correlation for these variables was -.48 for jogging, it was .15 for dancing. The magnitude and strength of the relationship for gazing and appropriate responding were similar for both treatments. It was -.40 for dancing and was -.30 for jogging. Nonetheless, it appears that both treatments might have affected gazing in a different way as suggested by its different association with heart rate for both treatments.

Figure 26

Comparison of gazing (Beh. B) in percentage of interval occurrences per session for subject 2

o=dancing □=control
●=jogging



Body rocking, twirling and tapping

The cluster of behaviors included under the category "Beh. C." were low incidence behaviors. The average for body rocking, legs swinging, repetitively touch or pull own clothes and twirling hair with fingers was slightly lower for dancing but almost equal to the average for jogging. Figure 27 displays the results for each session. The average result of interval recording for 15 minutes of jogging was 12.8% and the result for 15 minutes of dancing was 1.1%.

A negative correlation with heart rate of -.55 was obtained for beh. C for dancing. The same correlations was .25 for jogging. Beh. C also correlated .41 with appropriate responding for jogging as compare to .16 for dancing. A negative correlation of -.43 was obtained with beh. B for dancing while there was no correlation (0) for jogging. Other coefficients were also very low.

Vocalization

The average for 30 minute interval for vocalization other than talking (Beh. D) was lower for dancing. The exclusion of session 16, 18 and 22 slightly increased the difference between dancing and jogging. The average result for 15 minutes of jogging was 16.9% and the result for dancing was 8.4%. The results for each session and treatment are presented in figure 28.

A negative correlation of -.66 for vocalization with heart rate was obtained for dancing. This correlation was -.22 for jogging. The correlation of vocalization with other behaviors was different for both treatment. There was a correlation of .51 with "beh.C" for jogging while it was almost non-existent for dancing (.03). In addition, the correlation of appropriate responding with vocalization (beh. D.) was

Figure 27

Comparison of body rocking swinging and tapping (Beh. C) in percentage of interval occurrences per session for subject 2

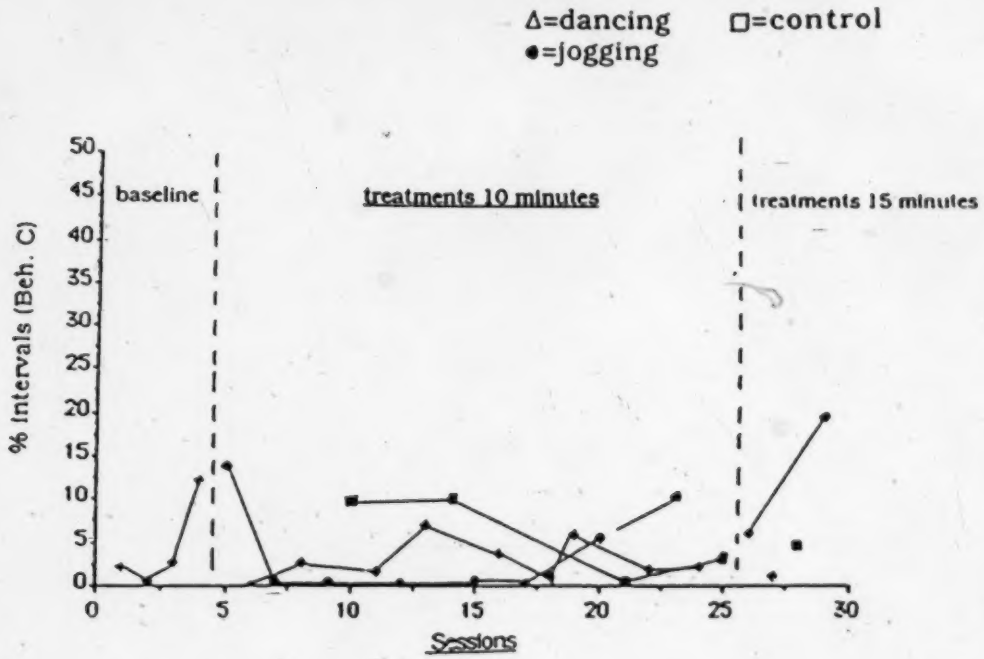
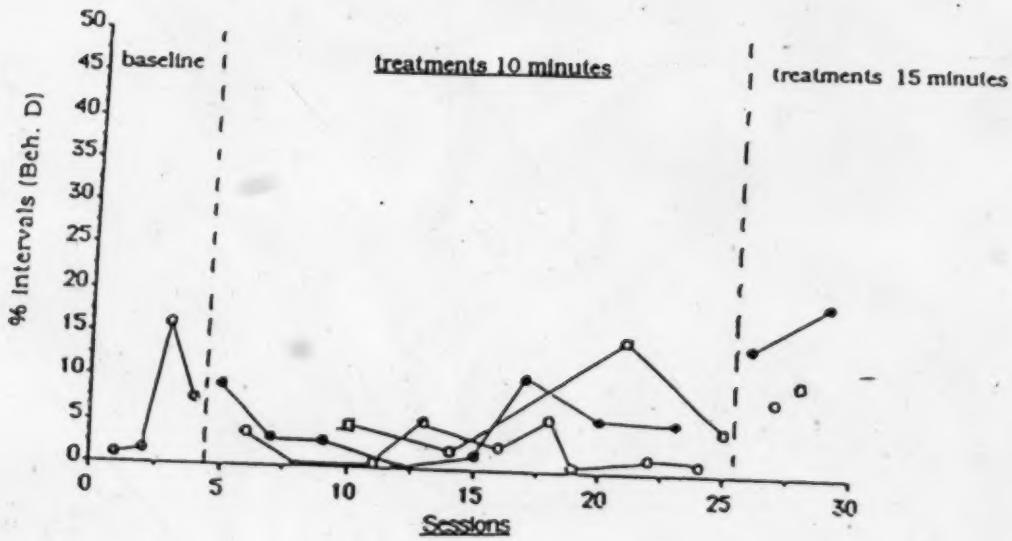


Figure 28

Comparison of vocalization (Beh. D) in percentage of interval occurrences per session for subject 2

o=dancing □=control
●=jogging



very different for jogging and dancing: For jogging the correlation was positive and was .79, while on the other hand the correlation for dancing was negative and was -.44. This, along with the previous data, suggests that the behavior (vocalization) may have served a totally different function for the two different treatment conditions.

Appropriate responding

The average for 15 minutes of interval recording for appropriate responding (App. resp. tot.) was higher for jogging than for dancing. However, the average for dancing was smaller than the average for control. When session 16, 18, and 22 were excluded from the calculation, the difference between dancing and jogging was reduced by an increase in the average for dancing. With the exclusion of these sessions the average for dancing was equal to the average for jogging. Figure 29 presents the results for each session and treatment without row exclusion.

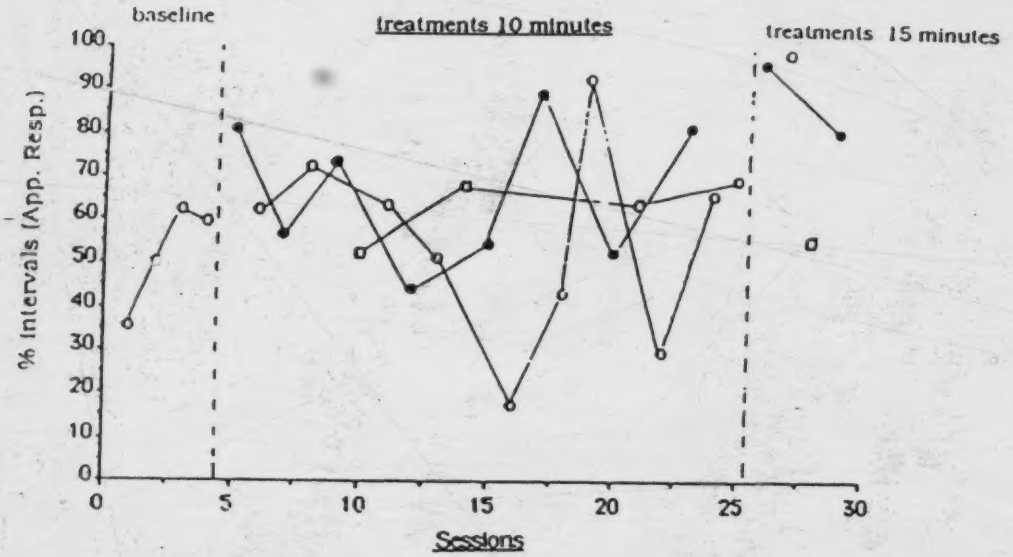
When the duration of exercise was increased from session 26, the average result for 15 minutes of jogging was 87.8% and the result for the dancing session was 97.7% while the result for control was only 55.2%. The mean for appropriate responding (app. resp. tot.) was much lower on the afternoon. The exclusion of the sessions made a large difference (+14.0%) on the average obtained for the last 8 minutes of appropriate responding (App. resp. 2nd).

The correlation obtained for heart rate and appropriate responding was .57 for dancing and -.13 for jogging. Also, as already mentioned, a high positive correlation or .81 was obtained with beh. A for dancing. This correlation was .44 for jogging. A correlation with appropriate responding of -.30 with beh. B and a correlation of .41

Figure 29

Comparison of appropriate responding (App. Resp) in percentage of interval occurrences per session for subject 2

o=dancing □=control
●=jogging



with beh. C were obtained for jogging. On the other hand, the correlations with the same behaviors were respectively -.39 and .16 for dancing suggesting a difference in patterns of association between the dependent variables for dancing and jogging.

Summary

Thus, to summarize the results for subject 2, for dancing the percent average was lower (desired effect) for 1) inappropriate behavior (beh. tot.), 2) gazing (beh. B), 3) body rocking, tapping and twirling (beh. C), and 4) vocalization (beh. D). On the other hand, the percent average was lower for "placing fingers in mouth" (beh. A.) for the control condition. For the jogging condition, the percent average was higher (desired effect) for appropriate responding (however, with the exclusion of session 16, 18 and 22, the average result was slightly higher for dancing). The relative order of the treatment effect remained unaffected by excluding session 16, 18, and 22. It is important to note that the differences obtained between dancing and jogging were small and not statistically significant for subject 2.

Summary of the results for both subjects

In this study overall behavioral reductions were obtained following both types of exercise for both children with autism. For both subjects, most behaviors were reduced while some other behaviors were slightly increased, and still others remained basically unchanged as compared to the baseline rate. In some cases (for example, inappropriate behavior for subject 1 and repetitively entering fingers in the mouth for subject 2, the target behaviors occurred less frequently in the control condition than in the exercise conditions. Also the control condition appeared to be more effective than jogging

in reducing several behaviors for subject 1. However, for both subjects dancing was generally more effective than jogging in reducing the target behaviors even though the heart rate of the subjects while dancing was generally below the heart rate for jogging. The data paths for dancing and jogging were generally distinct although some overlap was present. A statistically significant difference between the two treatments for the overall inappropriate behavior was obtained for subject 1 but not for subject 2. In fact the difference obtained in between dancing and jogging for subject 2 was not very large. Nonetheless, as suggested by the different correlation patterns obtained in between target behaviors, even if in some cases the difference of magnitude of effect was not large, a difference in patterns was obtained for jogging and dancing for both subjects suggesting that the treatment forms might differently affect the children. Both treatment forms are more similar on their effect on appropriate responding. Dancing and jogging, but also the control condition improved appropriate responding over the baseline condition.

CHAPTER VII

DISCUSSION

The results obtained in this study showed that both forms of exercise, that is ten minutes of jogging and ten minutes of energetic movements along with rhythmic music (dancing), reduced most of the target behaviors in the thirty minutes of observation following the exercise sessions for the two teenagers with autism. These results provided support for the first hypothesis; both forms of exercise would be effective in reducing behavior. However, the magnitude of the reduction was generally not very large as compared to the baseline condition. Also the control condition was more effective than jogging for several behaviors for one of the subject. In addition the alternating treatment design is not a strong technique to demonstrated change in behavior compare to a baseline condition taken prior to implement the treatment condition. The design is a comparative design and it is principally aimed at comparing the effectiveness of different treatments.

The results obtained in this study also partially support the second hypothesis, that is that the activity thought to provide higher level of sensory stimulation (kinesthetic, proprioceptive and vestibular stimulation) would be more effective in reducing inappropriate behavior. Dancing was found generally more effective than jogging in reducing most target behaviors. Jogging appeared slightly more effective than dancing for head banging and biting own forearm for one of the children. The control condition was found to be the most effective with one behavior for one child; repetitively placing fingers in the mouth. However it was also more effective than jogging for many

behaviors for subject 1. Dancing was most effective for most of the behavior. The difference obtained between the two treatments was statistically significant for one child but not the other (statistical tests could not be computed for the difference between the control condition and the two other conditions because only four data points were available). Patterns of correlation between behaviors for each child also suggested that the two forms of exercise might have affected the target behaviors in a different way even though the magnitude of the difference between dancing and jogging was not in general statistically significant.

The results of this study also support to some extent the third hypothesis, that is behaviors associated with no particular antecedent or external consequence were reduced to a greater extent than other behaviors associated with external events. However because most behaviors such as grabbing others, pulling hair or scratching hands that were maintained by external events were low occurrence behaviors, the comparison between the two types of behavior is difficult. In addition, behaviors such as head banging and biting own forearm were sometimes associated with a clear antecedent and/or consequence, while on other occasions they appeared to be associated with internal events without known external causes. For these reasons the difference obtained between the two types of behaviors should be interpreted with caution. Other studies where a precise functional assessment of multiple target behavior is included in order to identify the source of motivation of the behaviors are required in order to test this hypothesis.

It is problematic to infer from this study that behavior associated with a clear antecedent and/or consequence (an operant paradigm) would be less reduced by exercise than other behaviors associated with internal causes such as several form of stereotyped behaviors. However it is interesting to note that the behavior "repetitively entering fingers in and out the mouth" (Beh. A) for subject 2 was very resistant to change. In fact, the control condition was most effective in reducing that behavior than the two forms of exercise. Two of the reasons why this behavior was so resistant to change are perhaps related to the way it was acquired in the first place and also to the function it serves. This type of mannerism which was perhaps acquired through an operant paradigm was also highly positively correlated with appropriate responding. This suggests that it was probably not incompatible with appropriate responding which had a tendency to increase following exercise. It could be that relaxation or fatigue would be the important factor in reducing such a behavior because, as already mentioned, the control condition was the most effective of the three treatment forms.

In addition to the previous findings, it was found in this study that clustering several behaviors together for the purpose of measurement could hide or obscure several differences in the way the behaviors are being affected. For example, for inappropriate behavior for subject 1 (beh. tot.), a cluster of every inappropriate behavior selected was used to find the general trend of the results regardless of specific behaviors. A statistically significant difference between dancing and jogging was obtained. However, the control condition was more effective than jogging in reducing the cluster of behavior. When

one looks more closely at the results, one can see that the total for inappropriate behavior for jogging was being increased as compared to baseline because of one behavior; that is "breathing noise". That behavior was in fact a large contributor of "other behaviors" (Beh. O.-another cluster of behavior-) as reflected by the magnitude of the correlation for breathing noise with beh. O. (.70) for jogging. Thus, it appeared that grouping several behaviors together (like it was the case for several studies on the topic) can prevent observation of a true picture of the treatment effect.

It can be observed from the present study that different behaviors are indeed affected differently by exercise. Not only were there differences in the magnitude of reduction for some of the behaviors under one treatment condition, but also dancing and jogging did not reduce the target behaviors to the same extent and produced different patterns of correlation between the target behaviors. These different patterns of association between target behaviors suggest that the topography of the behavioral change was different for both forms of exercise and perhaps dependent on the form of exercise. In fact, there were some behaviors such as Beh. A for subject 1 (leg swinging, body rocking and head waving) that were highly inversely correlated with heart rate (-.81) for dancing while this correlation was -.24 for jogging. It could well be that the more the arms and legs were used during the dancing session (also probably the higher the heart rate), the more the behavior associated with the same body parts were reduced following the treatment phase. In other words, the corresponding topography of the target behavior with the movement

patterns involved during the exercise session might have played a role in the behavioral reduction obtained following the treatment phase.

As already mentioned, some behaviors were increased following the administration of exercise. Vocalization for subject 2 and breathing noise for subject 1 are two such behaviors that were increased compared to the baseline condition for jogging and dancing. It is interesting to note that these two target behaviors have something in common: they are both produced by the mouth. It could well be that they both reflect the oxygenation level of the children following exercise. Perhaps they are an appropriate measure of exertion produced by the exercise sessions for the two children in this study. The increase in breathing noise and vocalization might indirectly indicate that exertion have played a role in the behavioral changes obtained following exercise, although, as already suggested, it would probably not be the only mechanism involved.

Although it is quite clear from this study that exercise produced short-term reduction in behavior, it is not clear if the effects are long lasting. In fact, in this study there was an attempt to see if there would be a difference in behaviors between the first fifteen minutes of interval recording and the last fifteen minutes. There was also an attempt to see if there would be a difference between the first seven minutes of appropriate responding and the last eight minutes. Although there were differences obtained, they were not consistent. It appeared that no important difference was noted between the beginning and the end of the recording period. Other studies examining the long term duration of the treatment gains would be required.

In this study, because the average heart rate during the treatment phase for dancing was lower than for jogging for both children, one may speculate that the difference in results obtained for inappropriate behaviors between dancing and jogging could be attributable to such a difference; that is the lower the heart rate the more effective the treatment. However, that is not the case because if it were so, the control sessions which did not elevate the heart rate would have produced the best results: that is not the case for most behavior. Even if for subject 1 control was more effective than jogging for many behaviors, it was not more effective than dancing. This suggests that something other than the heart rate intensity might have accounted for the difference obtained between the treatment conditions.

It is interesting to note that the intensity of the exercise as measured by the heart rate in beats per minutes prior to measuring the target behaviors did not correlate highly with the target behaviors. In fact, for most behaviors the correlation with heart rate was low for both dancing and jogging. One possibility regarding why low correlations between heart rate and behavioral reductions were obtained is related to the nature of the measure. Perhaps the heart rate measures are not appropriately reflecting the intensity of the exercise session. In other words, perhaps the measure is not a very valid measure of intensity. Another possibility is that the intensity as measured by the heart rate is not a very important factor in obtaining a behavioral reduction. It could be that the duration of the treatment is more important that the heart rate. For example, when the treatment duration was increased from ten to fifteen minutes for subject 2, the

rate of appropriate responding increased. The rate of inappropriate behavior did not further decrease, but the target behavior appeared to be resistant to change.

Another possibility for explaining the difference between the two forms of exercise, as it was suggested in the literature review, is fatigue. One might argue that both forms of exercise did not produce the same amount of fatigue for both children. Perhaps dancing would have produced more physical (muscular) fatigue because of the movement pattern involved. However, this fatigue would probably have been detected in the rate of appropriate responding which showed almost no difference for both treatments for both subjects. Also, the heart rate for jogging was generally higher than the heart rate for dancing. One might easily assume that the higher the heart rate, the more likely one would experience fatigue. The higher heart rate for jogging is thus inconsistent with the explanation of fatigue as responsible for the difference between the two treatments.

This, however, does not necessarily mean that fatigue is completely ruled out as a reason why the behaviors are decreased following exercise. On at least some occasions following the administration of the treatment condition, these adolescents appeared to be fatigued. They did not react and move as fast as they normally did. In fact, subject 2 held her head in her hand on some occasions and refused to respond. For subject 1 he was sometimes sitting motionless on a chair in an inclined posture. Thus fatigue can not totally be ruled out as a mechanism of behavioral reduction. However, this is generally not reflected in the rate of appropriate responding obtained. Appropriate responding was generally at the same rate or

superior to baseline rate. It could be that the target appropriate responses were not totally incompatible with fatigue effect. That is the case for some responses for subject 1, because for example, one of the appropriate response was to sit straight in an upright posture without body rocking. On the other hand it could well be that although exercise produced physical fatigue, that psychologically or mentally the subjects were able to function at a rate equal or superior to their normal rate.

Some authors (Bachman & Sluyter, 1988; Backman & Fugua, 1988) have suggested exertion as the responsible factor for the reduction in behavioral problems. As already mentioned, this explanation cannot be completely ruled out from this study. Vocalization and breathing noise were increased and they probably both depend on the level of oxygen to the lungs. However, one should not forget that these responses increased and did not decrease following exercise. Therefore it is not clear how exertion could be involved as a mechanism to decrease behavior. Perhaps exercise produced an immediate and rapid feeling of well-being associated with changes in the oxygen level available to the body which in turn would lead to decreases in behavior.

This hypothesized feeling of well being could perhaps be associated with the release of endorphins during the exercise performance. However, as suggested by Surbey and associates (1984) study, the release of endorphins might depend on the intensity of exercise. It is interesting to note, however that if endorphins played a role in the behavioral change obtained, and if it depends on the intensity of exercise, it is certainly not the only mechanism involved.

Since dancing was less intense then jogging, and that the more intense form of treatment should produce more endorphins then jogging should have been more effective in increasing the feeling of well being and consequently decreasing behavior. It thus appeared that other more important mechanisms might be involved. However, the increase in endorphin level could probably explain why the rate of appropriate responding went up in this study when the treatment was increased to fifteen minutes for subject 2. In fact, endorphins are thought to play an important role in attention. According to Terenius (1982) consistent findings related to the role of endorphins in mood and attention have been obtained.

Other neurotransmitters involved in emotion are also released during and after exercise. Catecholamines which are released after exercise are liberated in a variety of stress states and reflect the intensity of emotional reactions (Ismail and Young, 1977) Perhaps some of these neurotransmitters played a role in the results obtained. However, from this study little can be said about this interesting role that the neurotransmitters might have played in behavior problems.

Another possible explanation of the behavioral reduction obtained and the differential effect of the treatment is perhaps related to the physical proximity with the subjects during the exercise period. McGee, Menolascino, Hobbs, and Menousek (1987) successfully treated several severe cases of self-injurious behavior and other forms of behaviors by getting at physical proximity in order to create an atmosphere of warmth and affection with the child being treated. In fact there are case studies that reported having succeeded with this approach with extreme forms of self-injurious behavior after having

failed with every other behavior management technique (Cullen, 1987). In the present study, the physical proximity was greater for dancing than for jogging. In fact, for both subjects hand-over-hand guidance was needed for most of the dancing sessions. Subject 1 also manifested his enjoyment for proximity during the end of the cool down period when he sat very closely with the researcher and would refuse to let go of his arms. Thus it could well be that, this proximity during dancing might have produced, at least in part, the differences between the two treatments. However, if proximity was the only factor involved in the behavioral difference, the control condition would have been as effective as dancing because the proximity, especially with subject 1 was being maintained.

It is not clear how physical proximity and warmth might lead to a decrease in behavior. However, one might argue that it produced a feeling of well being, or tension reduction just as other techniques aimed at reducing tension. Perhaps that the control condition was more effective than jogging for some of the behaviors because it also produced a feeling of relaxation or well-being on a child that was already agitated prior to start the treatment. For example, other techniques such as massaging someone with disabilities that also displayed behaviors excesses has been found to be effective at least in some cases (Taylor & Chamove, 1986) Other studies used many forms of vestibular and tactile stimulation to reduce stereotyped and self-injurious behaviors (Bright, Bittick & Fleeman, 1981; Bonadonna, 1981; Wells & Smith). It could well be that dancing and jogging are decreasing behavior in similar ways that these techniques, perhaps in altering the level of tension and arousal of the individual.

Dancing would be more effective than jogging perhaps because it provides a higher level of stimulation or arousal for the children involved in the study. However, if the explanation is accurate, one would expect to find differential effects on different type of behaviors (like in the present study) but also to find different type of exercise to affect different individuals in different ways. In other words, dancing would be more effective with some children and some type of behaviors but not with others. Other comparative studies on different types of exercise would be needed.

Conclusion

As predicted in this study, both forms of exercise produced different results on the target behaviors. Dancing and jogging were generally effective treatment forms for both teenagers with autism and mental handicaps even though the reduction obtained in behavior was sometimes small. Also the control condition was sufficient to decrease some of the behaviors for subject 1 and in some cases it was more effective than jogging. Although caution is needed in generalizing the results to a larger population, the results obtained with this study are consistent with the other studies described in the section on exercise that used exercise as a form of treatment. The results add evidence that ten minutes of aerobic exercise can be effective in reducing some subsequent forms of behavior excess of children with developmental disabilities.

To the author's knowledge, only two other studies have attempted to measure the efficiency of aerobic dancing in directly reducing behavioral excesses. One of the studies included two individuals with severe disabilities and used a single subject research

design (Bachman & Sluyter, 1988). The other study was a doctoral thesis. Fifteen students with emotional disturbances participated for six weeks in the study. However, in this study, aerobic dancing increased aggressive behavior in the school setting as measured by an inventory of overt and covert aggression (Hoffman, 1987). The present study adds support to Bachman and Sluyter's study in showing that ten minutes of aerobic dancing can be an effective form of treatment in reducing subsequent inappropriate behaviors (mainly stereotyped behaviors) of children with behavioral and developmental disabilities although it also showed that different behavior can be affected in a different way by the treatment.

It also appeared that the type of exercise may be an important factor in the reduction of behavioral problems since dancing was found more effective than jogging in reducing inappropriate behaviors. Other studies would be needed to compare other forms of exercise. The use of a small or a large trampoline might be an effective way in reducing stereotyped behaviors of some children because of the level of vestibular, kinesthetic as well as proprioceptive stimulation it would likely produce. More studies using aerobic dancing as a form of treatment are needed. In addition group games such as soccer or indoor hockey and other forms of aerobic activities should be systematically investigated. The duration and the intensity of the exercise involved could be varied and the long term effects of exercise on behavior and on appropriate responding could be investigated.

The results of the present study add indirect evidence that the manipulation of antecedent and the selection of activities to incorporate in the student's curriculum are very important and can

have beneficial effects on the behavioral excesses of students with developmental disabilities. The implementation of exercise in the curriculum of at least some students with severe or moderate developmental disabilities with behavioral problems (including assessment of the effect) can serve as an alternative or partial component in managing some forms of problem behavior. In fact because of the lack of assistance often found in special education or regular education classrooms (where some students are integrated), and the impracticality of several direct behavior management techniques, exercise could serve as a good alternative. Many forms of behavior problems including self-stimulation can lead to social rejection and can perhaps trigger adverse feelings towards, or support negative stereotypes of, the population of individuals with developmental disabilities. However, some of these behaviors are often not serious enough to warrant the use of direct intervention. Thus an indirect approach, such as implementing exercise in the curriculum would be more appropriate in dealing with them. In addition exercise could have health benefits for the children and other social advantages (Halle, Gabler-Halle & Bemben, 1989).

As shown in the present study, additional benefits such as the increase of some forms of appropriate responding could be associated with the implementation of exercise.. However, in doing so individual preferences as well as strengths and weaknesses of each child would need to be assessed by a team of professionals. The effect of exercise on behavior and the individual would also need to be evaluated, because, as already shown by several researchers (Halle, Gabler-Halle & Bemben, 1989; Hoffman, 1987), some negative effects such as

increase seizure activities, or increase in some forms of behaviors have been reported. In others words, although exercise would be recommended for most individuals with severe disabilities, cautions are advised in implementing exercises programs.

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Appendix 1

INFORMED CONSENT FORM
The University of Alberta

Title of investigation: Comparison of two forms of antecedent exercise and their effects on inappropriate behaviors and appropriate responding with individuals with severe disabilities.

Investigator: Denis Fortin Date: May 14th 1990

This is to certify that I._____,hereby (give permission to have my child) agree to participate as a volunteer in a scientific investigation as an authorized part of the requirement of the master of education program in educational psychology of the University of Alberta under the supervision of Dr. Dick Sobsey.

The investigation and my (child's) part in the investigation have been explained to me by Denis Fortin and I understand his explanation. The procedures of this investigation are described on the attached sheet and have been discussed in detail with me.

I have been given an opportunity to ask whatever questions I may have had and all such questions and inquiries have been answered to my satisfaction.

I understand that any data or answers to questions will remain confidential with regard to my identity and the child's identity.

I understand that, in the unlikely event of physical injury resulting from this investigation, no financial compensation is provided. Further information on this policy is available from the Faculty of Graduate Studies and Research.

I recognize that my child must have no physical condition preventing his/her participation in the study. For this reason I included the attached form regarding the physical status of the child. It should be signed by the parent/guardian who has consulted with the child's physician, or it may be signed by the physician.

(continued)

I FURTHER UNDERSTAND THAT I AM FREE TO WITHDRAW MY CONSENT AND TERMINATE MY (THE CHILD'S) PARTICIPATION AT ANY TIME.

_____
Date

_____
Signature of parent or guardian

I, the undersigned, agree to let my child participate in the study.

_____
Date

_____
Investigator's signature

I was present when the above was explained to the subject in detail and to my best knowledge and believed it was understood.

_____
Date

_____
Witness

DESCRIPTION OF THE RESEARCH PROJECT

In this study an alternating treatment design (single subject research design) is used to compare the effect of 10-20 minutes of jogging and 10 minutes of informal aerobic dancing on different aberrant behaviors, as well as on appropriate responding of children with moderate or severe disabilities. Behaviors such as stereotyped behavior which are generally not associated with a particular environmental antecedent or consequence are selected. Other inappropriate behaviors for which a particular antecedent and/or consequence are identified, are also concurrently present for each selected individual.

During the treatment phase, the child is taken to the gymnasium of the school. After a brief warm up, the child will be jogging with the experimenter around the gymnasium for a period of 10-20 minutes or he/she will be dancing for the same duration. The two conditions are alternated in a systematic manner so that each condition is presented for the same amount of times. No more than two exercise sessions are administered during one day; one condition being presented on the morning and one in the afternoon. Each form of aerobic exercise will be performed to a maximum of 15 times during the experimentation. The child is videotaped for 30-45 minutes following the exercise sessions. The measurements of the behaviors are made from the tape.

PHYSICAL STATUS OF RESEARCH PARTICIPANT

This letter is to acknowledge that _____ has no physical condition and is taking no medication that could interfere with the child's well being during his/her participation in the research project involving aerobic exercise. Conditions such as jogging or dancing are performed for 10-20 minutes at the time. A maximum of two exercise conditions are introduced per day.

I _____(parent/guardian and/or physician) acknowledge that this child is free of medical condition preventing his/her participation in the study.

Date:_____

FOR FURTHER INFORMATION CONTACT DENIS FORTIN AT 438-1347

appendix 2

Data summary for subject 1

Sessions	Date	Mins	Treatment	Heart rate	Bch. 1st 15 min.	Bch. 2nd 15min.	Bch. total	Bch. 1[]pch. E	Bch. V	Bch. O	Bch. B	Bch. Y	Bch. A/(O)	Bch. /(O)pch. C/(O)	Bch. H.B	Bch. H.S	Bch. G
1	12/08	a.m.			76.9	90.0	85.0	18.3	28.7	18.3	51.7	3.9	1.7	30.0	37.8	0	0	1.0	0
2	13	p.m.	baseline	-	76.9	97.9	87.9	67.9	18.7	18.7	85.3	1.3	3.2	58.9	14.4	0	0	0	0
3	13	a.m.	baseline	-	77.8	78.7	78.7	1.0	28.3	2.8	31.3	0	0	44.4	14.4	0	3.9	.8	0
4	15	a.m.	baseline	-	100.0	97.8	98.9	17.3	85.8	42.3	88.4	.8	1.1	56.7	37.8	0	.8	18.0	0
5	20	a.m.	caffeine	138.8	88.7	84.7	81.7	5.0	8.4	1.7	47.8	0	0	31.1	43.3	0	0	0	0
6	20	p.m.	decaf	140.8	74.4	81.5	77.7	8.0	15.1	14.5	70.5	0	1.8	4.4	56.7	0	0	0	28.3
7	21	a.m.	caffeine	137.8	70.8	-	82.2	0	16.8	2.7	48.7	0	0	30.7	44.3	0	0	.8	0
8	27	a.m.	decaf	131.0	71.1	91.1	86.1	0	13.3	2.3	48.1	0	1.0	24.4	33.3	0	0	0	0
9	1/08	a.m.	control	-	72.3	97.8	76.0	3.9	25.8	10.0	42.2	0	.1	20.0	35.6	0	2.3	0	0
10	4	a.m.	baseline	144.8	76.9	97.8	83.3	1.1	30.9	17.2	80.8	.1	.1	17.8	41.1	0	0	1.1	0
11	4	p.m.	caffeine	140.8	71.4	41.1	56.4	0	1.7	4.5	22.7	.1	.1	19.8	10.4	0	0	0	.8
12	6	a.m.	decaf	140.8	80.8	86.7	68.9	0	17.7	8.1	80.0	0	0	30.0	28.7	1.1	0	0	0
13	8	p.m.	caffeine	140.5	80.8	82.2	83.9	45.0	83.2	38.4	80.4	0	0	43.3	22.2	0	2.3	.8	0
14	8	a.m.	control	-	82.3	88.9	85.7	0	4.1	2.3	85.8	1.7	0	33.3	15.7	5.6	0	1.1	2.6
15	11	a.m.	baseline	-	88.7	85.8	76.1	8.7	20.8	10.8	68.9	0	0	58.9	45.6	0	0	1.7	0
16	11	p.m.	caffeine	148.4	79.3	97.8	85.5	1.1	16.2	2.3	80.3	1.1	0	8.7	50.0	0	2.3	0	.8
17	13	a.m.	decaf	148.3	80.9	88.9	86.1	0	36.3	26.7	80.8	.8	.8	33.3	54.4	5.5	0	0	0
18	13	p.m.	caffeine	154.4	80.0	97.8	83.9	.8	36.3	22.9	82.0	.8	.8	7.8	63.3	0	.8	0	0
19	15	a.m.	decaf	138.0	75.8	70.0	72.8	0	15.8	2.7	85.8	2.1	0	28.9	34.4	0	0	0	5.6
20	15	p.m.	caffeine	138.8	75.8	82.8	81.1	.8	18.1	10.1	83.4	0	0	10.0	54.4	0	0	0	7.2
21	13	a.m.	control	-	84.1	84.4	86.1	18.3	8.9	18.3	70.5	2.8	.8	58.9	57.6	0	0	1.1	1.1
22	18	a.m.	decaf	136.3	81.1	74.4	87.8	1.7	15.0	13.8	48.4	0	.8	27.8	33.3	0	0	0	0
23	18	p.m.	caffeine	134.5	87.8	97.8	97.4	30.8	21.7	43.8	75.8	0	2.9	34.4	46.6	0	0	0	12.9
24	18	a.m.	decaf	134.5	80.0	90.0	90.0	0	5.0	4.4	38.3	0	0	44.4	25.5	0	0	0	0
25	19	a.m.	control	132.8	87.8	86.7	87.3	0	16.7	10.1	83.0	1.3	0	43.6	32.1	0	0	0	0
26	23	a.m.	control	-	81.1	86.1	74.7	0	26.1	20.8	43.3	0	1.1	30.9	20.0	0	0	0	0
27	25	a.m.	control	-	87.8	88.0	81.8	0	4.7	21.8	47.8	0	0	27.8	28.7	0	0	.8	0

	Appr. resp. 1st 15min.	Appr. resp. 2nd 8min.	Appr. resp. total	Bir. only/group. n°01
1	45.8	33.3	34.7	39.3
2	11.3	4.3	16.6	0
3	0.3	26.8	19.3	2.7
4	26.1	18.8	27.8	10.3
5	33.3	43.7	36.0	45.1
6	7.1	26.4	18.8	29.3
7	29.9	40.8	36.1	38.8
8	37.1	36.4	43.8	41.9
9	67.8	35.3	41.1	37.2
10	36.7	41.7	36.9	36.7
11	40.0	41.7	40.8	5.0
12	18.8	47.8	33.3	28.5
13	36.1	37.1	36.7	18.1
14	36.1	37.8	38.8	12.8
15	31.9	28.8	24.3	14.5
16	36.1	47.8	42.3	77.8
17	10.9	38.1	24.4	44.4
18	20.5	18.8	8.1	86.6
19	11.4	18.6	10.8	23.4
20	38.5	41.8	48.4	83.0
21	18.8	37.8	37.7	17.4
22	28.5	86.8	44.4	37.5
23	33.3	8.3	21.3	84.4
24	30.4	38.4	31.3	18.4
25	18.8	36.3	34.8	23.8
26	18.8	21.1	21.1	25.3
27	36.3	33.3	33.3	36.8

appendix 2 (cont.)

Data summary for subject 2

	Sessions	Date	Time	Treatment	Heart rate	Bch. 1st 15 min.	Bch. 2nd 15 min.	Bch. Total	Tch. A	Tch. B	Tch. C	Tch. D	App. Resp. Total	App. Resp. 1st 7 min.	App. Resp. 2nd 8 min.	
1	1	12/06	p.m.	baseline	*	77.5	66.7	72.1	50.3	24.6	2.2	1.1	35.5	33.3	37.5	
2	2	12	a.m.	baseline	*	85.1	64.7	74.1	63.7	17.2	.6	1.7	60.0	54.8	41.7	
3	3	25	p.m.	baseline	*	77.8	72.3	75.0	75.7	12.2	2.8	10.1	60.2	54.8	66.7	
4	4	26	a.m.	baseline	*	85.1	70.8	68.4	45.8	14.6	12.3	7.6	59.8	43.0	72.9	
5	5	29	p.m.	Jogging	166.6	75.3	76.5	75.0	63.3	15.0	13.9	8.4	81.1	64.3	85.6	
6	6	30	a.m.	Dancing	141.0	68.6	60.0	64.4	61.8	3.3	0	3.0	62.2	66.7	58.3	
7	7	30	p.m.	Jogging	150.0	85.3	68.7	85.0	85.0	10.8	.8	3.3	56.7	50.5	64.1	
8	8	31	a.m.	Dancing	142.2	82.3	72.2	82.2	58.3	4.4	2.8	0	72.2	85.7	62.5	
9	9	01/07	a.m.	Jogging	155.0	84.4	81.3	57.7	44.0	10.4	0	2.9	73.3	66.7	80.4	
10	10	1	p.m.	Control	*	78.4	64.3	71.3	42.7	10.9	9.8	4.9	52.2	47.6	68.5	
11	11	4	a.m.	Dancing	161.0	86.8	83.3	84.4	48.4	1.1	1.7	.8	68.3	76.2	37.5	
12	12	4	p.m.	Jogging	148.4	79.2	47.8	80.0	38.4	8.9	0	0	44.4	35.7	82.1	
13	13	5	a.m.	Dancing	132.2	72.0	68.0	69.4	41.1	0	7.3	6.8	51.1	57.1	45.8	
14	14	5	p.m.	Control	*	68.7	51.7	58.2	41.1	8.7	10.0	2.2	67.8	78.6	58.3	
15	15	6	a.m.	Jogging	148.1	83.4	84.4	76.2	48.1	20.0	.8	1.7	54.5	52.5	56.3	
16	16	8	p.m.	Dancing	147.1	84.7	34.4	45.8	31.1	8.3	3.0	2.8	17.7	30.9	6.3	
17	17	11	a.m.	Jogging	137.0	87.7	78.0	71.1	64.0	.8	0	10.8	68.9	76.2	100.0	
18	18	11	p.m.	Dancing	134.6	86.8	58.8	63.8	45.3	10.8	1.1	6.1	43.3	14.3	68.8	
19	19	12	a.m.	Dancing	140.8	87.8	54.5	61.2	52.2	3.3	8.1	.8	62.1	85.8	89.3	
20	20	13	p.m.	Jogging	148.8	87.2	44.4	50.8	37.4	10.8	5.8	6.1	82.2	40.4	82.5	
21	21	14	a.m.	Control	*	84.4	80.0	87.2	48.8	14.4	0	15.0	63.3	71.4	56.3	
22	22	15	p.m.	Dancing	148.0	82.3	44.8	63.5	28.3	15.0	2.0	1.7	29.5	14.3	43.8	
23	23	15	a.m.	Jogging	141.3	87.0	86.8	61.4	45.1	8.9	10.3	8.7	60.7	71.4	86.1	
24	24	15	p.m.	Dancing	136.8	78.8	73.3	74.4	48.3	17.4	2.3	1.1	65.8	80.0	82.5	
25	25	19	a.m.	Control	*	78.9	83.3	84.4	48.7	18.1	3.3	6.0	68.8	71.4	66.8	
26	26	18	a.m.	Jogging	143.6	82.3	84.4	83.3	35.0	8.3	8.1	14.4	85.5	100.0	71.8	
27	27	19	a.m.	Dancing	138.0	82.3	84.4	85.3	44.7	7.8	1.1	8.4	87.7	100.0	75.8	
28	28	20	a.m.	Control	*	84.8	43.7	45.1	38.8	0	4.8	10.3	86.2	46.8	68.8	
29	29	25	a.m.	Jogging	145.1	85.5	83.3	83.3	48.3	.5	10.4	16.4	80.0	71.4	87.5	